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MAY 21, 1945

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CALENDAR OF COMING EVENTS

Meeting, Northern New England Section, Andover Country Club, Andover, Mass., May 25th, 1945. "Court Scene"—The court will try the case of "Synthetic Detergents vs. Soaps."

Meetings, Council and Research Committee, New York City, June 22, 1945. Chairmen of Sub-Committees who wish to hold meetings on June 21st should notify Dr. Louis A. Olney.

Outing, Philadelphia Section, Melrose Country Club, June 22nd, 1945.

OTHER ASSOCIATION MEETINGS

Meeting, American Association of Textile Technologists, Builders Club, New York City, June 6th, 1945.

The Pad-Steam CONTINUOUS DYEING PROCESS*

P. L. MEUNIER

Technical Laboratory, Organic Chemicals Dept., E. I. du Pont de Nemours & Co., Inc.

DURING these wartime years much emphasis has been placed on the need for stepping up production of all manufactured goods and, at the same time, maintaining or, if possible, increasing the quality of these articles of manufacture. This applies to the textile industry as well as to other fields of production and certainly it applies to the dyer and finisher of textiles. From time to time, during the war he has been faced with serious shortages of color and other processing chemicals and manpower. In war and peacetime he must also meet a growing consumer demand for high quality and low cost. But while this emphasis on increasing the speed and quality of production is so noticeable now, every textile chemist and colorist has always recognized that the ultimate goal in textile coloration is continuous production of a full range of attractive shades with maximum durability at low cost.

It is universally accepted that the vat colors approach this goal of maximum durability in the full range of shades more closely than any other class of dyestuffs on cotton and rayon textiles; recent technical developments have extended the use of these dyestuffs to wool and mixed-fiber fabrics.

Three important methods of applying vat colors to textiles have been known for some time; namely, the pigment pad-jig development method, which is a batch process, as distinguished from continuous processes; the reduced pad-continuous proess of Tice [1] employing caustic soda and sodium hydrosulfite booster baths; and the reduced pad-continuous process of Wentz [2] employing soda ash and sodium hydrosulfite booster baths. The pigment pad-jig development process yields the maximum in color fastness; but, since it is a batch process, it is more expensive than the continuous processes. The reduced pad-continuous method of Tice is suitable for the application of light to medium shades on long yardages of fabrics. The establishment of equilibrium conditions in the booster baths requires close attention and results in the production of substantial amounts of seconds until equilibrium conditions are established. The process of Wentz substitutes soda ash for caustic soda in the booster baths and results in better control of booster bath conditions. It also makes possible the dyeing of fabrics containing alkali sensitive fibers such as wool and acetate leaving these fibers white.

Many investigators have attempted to bring about improvements over these processes. This paper describes the results of a major investigation which has been under way for a considerable time directed toward the development of improved continuous processes for the application of vat colors to piece goods. The objectives of this investigation may be summarized as follows:

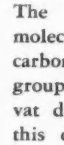
1. The new processes should produce color effects of the maximum fastness and best appearance obtainable with the vat colors.
2. The operation of the processes should be simple and flexible, in order that they can be applied to the widest possible variety of fabrics in short as well as long yardages.
3. The new methods should be applicable to the production of a full range of color effects from pastels to deep shades.
4. The new processes should achieve minimum cost of application.

THE CHEMISTRY OF THE VAT DYEING PROCESS

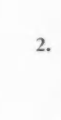
A typical vat color as manufactured might be represented by the simple formula:

The "A" represents the large dyestuff molecule minus one of the "C=O" or carbonyl groups. Several such carbonyl groups may be present in the complex vat dye molecules, but for purposes of this discussion only one need be considered.

The "C=O" represents the chemically reactive portion of the dyestuff molecule through chemical reduction of which the dyestuff is transformed temporarily into an alkali-soluble "leuco" derivative. The sodium salt of this "leuco" derivative may be represented by the formula:



It will be noted that the "A" representing the major portion of the color molecule has remained unchanged, but the "C=O" has been converted to the sodium salt of a weak acid, thus imparting water solubility temporarily to the large molecule. The "leuco" derivative penetrates the cotton fiber and is retained within the fiber by its so-called "substantive" properties. After the uniform distribution of this "leuco" derivative through the fibers of a textile material, oxidation converts the "leuco" derivative back to the original vat color represented by:



This insoluble color now is distributed uniformly throughout the fibers in minute particles, which are retained in place by physical and chemical forces which resist removal by abrasion (crocking), washing, bleaching agents and other destructive mechanical and chemical influences. Furthermore, because of the large surface area of these minute color particles, a uniform color effect is obtained throughout the textile; and because of the chemical nature of the vat dye, this color effect exhibits excellent stability to light.

The photomicrographs and discussion, which follow, illustrate cotton and rayon fibers (1) pigmented on the surface and (2) properly dyed with vat colors, showing how the vat dyes virtually become an integral part of the fibers as a result of the dyeing process.

THE NATURE OF A VAT COLOR DYEING

Figure 1 is a photomicrograph of a few cotton fibers pigment-padded with a combination of highly dispersed vat colors. Note that the minute pigment particles are deposited on the *surfaces* of the fibers. Obviously, they can be removed rather readily by washing or scrubbing, crocking, etc.

* Presented at meeting, New York Section, January 12, 1945.

[1] U.S.P. 1,652,649.

[2] U.S.P. 2,318,133.

Figure 1

Figure 2

Figure 2 is a photomicrograph of a few fibers of the same fabric subsequent to dyeing with the vat colors by a proper method, such as the du Pont Pad-Steam Process. The pigment particles visible in Figure 1 have been reduced to the soluble "leuco." The "leuco" has penetrated into the interior of the individual fibers, and there the insoluble vat dye has been regenerated as minute insoluble particles. The removal of the color by washing, crocking, etc., is now extremely difficult, since the color particles are *inside* the individual fibers rather than on the surface. It might be stated with justification that the vat dyestuff is now an integral part of the cotton fiber.

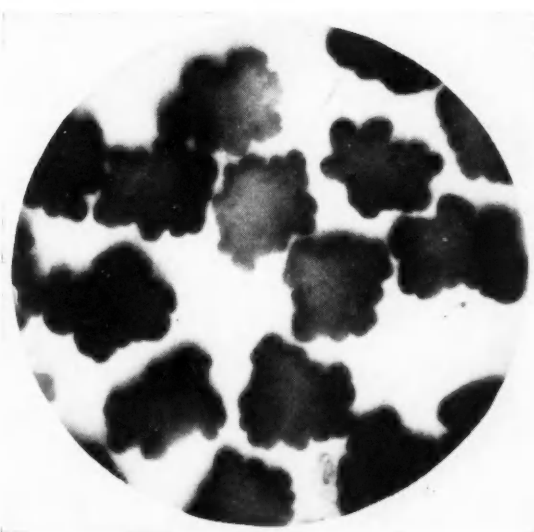
Cotton fibers are variable in diameter and rather opaque when photographed at high magnification. Viscose-process rayon, another cellulosic fiber extensively dyed with vat colors, is more uniform in cross-section and much more transparent. For this reason, similar photomicrographs have been prepared of rayon fibers.

Figure 3 is a photomicrograph of a few fibers of a viscose-process rayon fabric pigment-padded with dispersed vat colors, and Figure 4 is a similar picture of fibers of the same fabric after proper dyeing with vat colors. The results are identical with those illustrated on cotton, but the photomicrographs present a more striking picture of the same phenomena.

Many reducing agents have been employed for the conversion of the insoluble vat color to its "leuco" form, but sodium hydrosulfite is the most common and economical reducing agent. An alkali, usually caustic soda, is used in conjunction with sodium hydrosulfite. In the customary vat color dyeing processes, the reduction with sodium hydrosulfite and caustic is conducted at 120° to 140° F. Usually 15 minutes to an hour or more is allowed for the complete reduction of the insoluble color to the soluble "leuco" derivative, depending upon the nature of the specific process employed and the vat color selected. It has been known for years that the time of reduction can be decreased substantially by employing higher temperatures, but it also has been known that

Figure 3

Figure 4



many of the "leuco" derivatives are not chemically stable at higher temperatures. Frequently, vat colors undergo serious chemical changes when subjected to high reduction temperatures for appreciable periods of time. For example, loss of chlorine from certain vat blues, with a consequent loss in fastness properties, occurs under these conditions.

The most important observation leading to the development of a new process was the fact that reduction of the vat color to the "leuco" on a fabric can be carried out completely in a matter of *seconds* at a temperature of 212° F., and that under these conditions, uniform distribution of the soluble "leuco" throughout the textile material also will take place *in a few seconds*. Furthermore, the chemical stability of the "leuco" at this temperature for the short period of time required for reduction and distribution (fixation or "development") is entirely satisfactory. When applied under these conditions, the vat colors are unchanged chemically. The dyeings are identical in their properties with those produced under the customary lower temperature conditions.

DEVELOPMENT OF THE FUNDAMENTAL PROCESS

The fundamental observations on reduction and fixation of vat colors at 212° F., stated above, indicated that if it were physically possible to deposit the vat color and reducing agent on a textile fabric and subject the fabric in the presence of moisture to a temperature of 212° F. for a short period of time, satisfactory fixation of the "leuco" derivative could be expected. Because the time required for the basic chemical and physical operations could be so short, a splendid opportunity was offered for continuous operation. The next steps of the study, therefore, were directed toward mechanical means of producing the desired conditions.

Without discussing in detail the numerous experiments and early failures, it will suffice to state that the desired combination of conditions was found. These conditions involved the following operating steps:

1. Deposition of the vat color on the fabric by the pigment-padding procedure.
2. Drying the padded fabric.
3. Re-padding the fabric with a solution containing sodium hydrosulfite and caustic soda, plus an auxiliary material to suppress migration of the color. Suitable auxiliary materials were common salt or sodium formaldehyde sulfoxylate (Sulfoxite C).
4. Steaming the fabric for less than 1 minute at 212° F.

(It should be emphasized that the rigid exclusion of air [oxygen] is necessary during the steaming. Obviously, one reason for this is to avoid destruction of the sodium hydrosulfite. In addition, it appears essential to the successful operation of the process that the "leuco" form of the dyestuff shall not have an opportunity to oxidize during the steaming operation, even though sufficient reducing agent is present to re-reduce any oxidized color.)

At the conclusion of these steps, which can be operated in a continuous manner, the fabric is oxidized by any of the conventional processes to regenerate the vat color in its insoluble form, and then finished by the customary soaping, rinsing and drying.

To the dyer familiar with past practices in the application of vat colors, the reasons for the success of the new process may not be too apparent. Therefore, we shall summarize the important points in the successful operation of the process. Failure to observe the necessity for *all* of these conditions probably accounts for the failure of previous studies.

1. Uniform padding of a properly prepared fabric.
2. "Chemical padding" with hydrosulfite and caustic under controlled conditions of pickup, with the temperature of the padding held below that at which substantial reduction of the dyestuff occurs prior to steaming.
3. The use of sodium hydrosulfite as a reducing agent rather than the more stable Sulfoxite C.
4. Steaming the fabric in the wet state.
5. Steaming at 212° F. or slightly higher in the absence of any appreciable amount of air. Even though it is commonly believed that the customary agers for vat dye printing are air-free, such equipment has not been found suitable for the process unless all air leaks and other means by which oxygen can be introduced have been eliminated.
6. An adequate flow of steam through the steamer is necessary and the steam must be distributed uniformly over the fabric surfaces.
7. The steam in the steamer must be saturated with moisture or very close to this condition in order that drying out of the fabric shall not occur during the steaming operation.

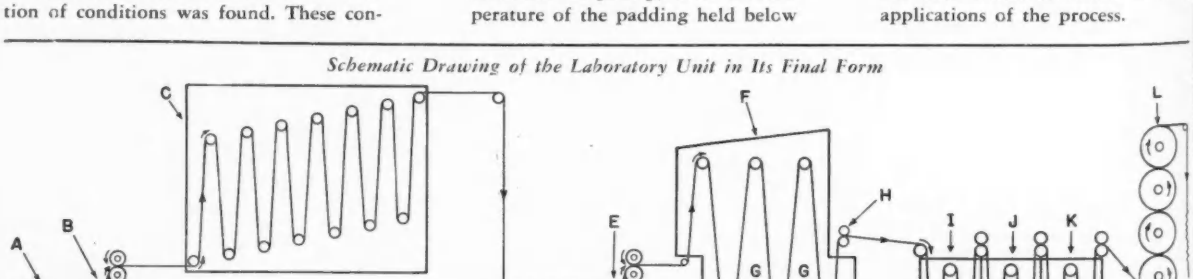
EQUIPMENT

A unit for the operation of the process was designed and constructed, then modified as experimental work progressed. Shown in the sketch is a schematic drawing of the laboratory unit in its final form. The legend accompanying the drawing indicates the various components of the complete unit. It will be obvious to the experienced dyer that the new unit involves no equipment of an unusual nature. Rather, the unit is an assembly of relatively orthodox equipment in a new arrangement.

The steam chamber (F) is the only somewhat novel apparatus, and it differs from conventional steaming equipment only in the following mechanical and operating respects:

1. The usual period of exposure of the fabric in this unit is less than 1 minute; in fact, 10-second steaming has been found sufficient in many applications of the process.

Schematic Drawing of the Laboratory Unit in Its Final Form



A. FABRIC
B. PIGMENT PADDER
C. FLUE DRYER
D. COOLING CAN
E. CHEMICAL PADDER
F. STEAM CHAMBER
G. PARTITIONS FOR LIQUID BOOSTER BATHS
H. SQUEEZE ROLLERS
I. OXIDATION BOX
J. SOAPING BOX
K. HOT WATER RINSE BOX
L. DRYING CANS

2. An adequate supply of steam is required and a sufficient flow of steam is necessary to prevent the introduction of any appreciable quantity of oxygen (air) into this unit.
3. Uniform distribution of the steam over the fabric surfaces is necessary to obtain uniform color development.
4. Precautions must be taken to avoid dripping of steam condensate on the fabric, otherwise spotting of the dyeings may result.

It will be noted that partitions (G) are provided in the bottom of the unit. In certain modifications of the basic process, to be described later, small liquid developing baths (boosters) may be used in conjunction with the steaming for color development. The partitions make possible the utilization of one, two or three liquid boosters.

DESCRIPTION OF THE PROCESS

The fabric to be dyed is prepared in the usual manner. For best results, thorough preparation of the fabrics is desirable. The prepared fabric is pigment-padded in the conventional manner in the padder (B). A two-bowl padder is shown, but for many fabrics, a three-bowl padder may be more satisfactory. The padded material is dried in the flue dryer (C). Any type of drying satisfactory for pigment-padded fabrics may be substituted for the flue dryer. Obviously, the fabric must be dried uniformly on both sides in order to avoid pigment migration.

The dried fabric is passed over a cooling cylinder (D), then passed through a "chemical pad" on padder (E). This "chemical pad" consists of a solution of sodium hydrosulfite and caustic. To the "chemical pad" or to the pigment-pad solution, common salt, Sulfoxite C, or an equivalent agent is added to suppress any migration tendencies. The cooling cylinder is included since the chemical padding should be carried out below 100° F.

The fabric passes from the "chemical pad" to the steam chamber (F), this distance being held as short as possible to avoid loss of reducing agent from the fabric due to air oxidation. The fabric is steamed for less than a minute in a saturated steam atmosphere at 212° F. or slightly higher. During this steaming the vat color is reduced and the "leuco" derivative penetrates thoroughly into the fabric and is fixed.

From the steam chamber the dyed fabric is subjected to conventional oxidation, soaping, rinsing and drying. In the schematic drawing of the laboratory unit, three boxes: I, J, and K are shown at the end of the steamer. Actually, these boxes and the dry cans, L, have not yet been

Photograph of the Pad-Steam Continuous Dyeing Process

constructed but the dyed fabric may be finished in a continuous manner in units such as these. In a series of boxes such as those pictured in the drawing, the fabric may be rinsed with hot water, oxidized with sodium perborate, scoured with "Modinal" D and then rinsed. At this point the fabric is ready for drying by any suitable method. (On the accompanying sketch, drying is indicated on a can stack, but as stated above, this equipment is not available in the experimental unit.)

The following specific procedure is provided to illustrate the operation of the process:

Cotton herringbone twill, as supplied for the U. S. Army clothing, was padded through a bath of the following composition at 140° F.:

6.5 oz. per gal. Ponsol Khaki 2G Paste
4.4 oz. per gal. Ponsol Olive GGL Paste (Pat.)
0.85 oz. per gal. Ponsol Brown AG Double Paste
0.2 oz. per gal. Alkanol B

The pickup was 50 per cent, calculated on the dry weight of the fabric.

The fabric was dried, then passed through the following "chemical pad" bath at 90° F.:

6 oz. per gal. Caustic Soda
6 oz. per gal. Sodium Hydrosulfite
6 oz. per gal. Common Salt

The pickup of this operation was 50 per cent by weight, based on the dry fabric.

The fabric then was steamed for 45 seconds at 212° to 214° F.

Precautions were taken to displace all the air in the steam chamber with saturated steam and to bring the temperature uniformly to 212° to 214° F., prior to this steaming operation.

The developed dyeing was oxidized for 1 minute in 0.5 per cent sodium perborate solution at 180° F., rinsed in cold water, and then soaped at the boil, rinsed and dried.

RESULTS OBTAINED BY THE PROCESS

Extensive application of this process to the full range of vat dyestuffs applied to a variety of fabrics justifies the general statement that the shade, brilliancy, clarity and general appearance of the dyeings are equal to the best commercial work by conventional methods, such as pigment pad-jig application. The color value obtained from the dyestuffs, likewise, is equal to that obtained by the older processes. Furthermore, the all-around fastness of the dyeings is equal to the best results obtainable by the methods now in operation. This includes fastness to light, abrasive washing, bleaching and other destructive agents. This fastness is to be expected since a careful examination of the dyeings indicates excellent penetration and fixation of the dyestuffs.

The uniformity of dyeing results obtained by the new method is due primarily to the fact that the vat colors in pigment form are deposited uniformly over the fabric surface by the mechanical operation of padding; then the dyestuffs are reduced and fixed without exposure to liquid baths which would permit partial removal of the dyestuffs or their "leucos" and re-fixation elsewhere on the fabrics. Of course, it is necessary to successful operation of the process that the padding be uniform. The dyestuffs are deposited uniformly on the fabrics, then fixed in that position. The analogy with vat color printing technique is obvious. Among the difficult problems avoided by this technique is the elimination of color exhaustion and different rates of exhaustion of the component colors in a combination.

Although the story of this new application process has been presented from a laboratory point of view, the process has been confirmed on a practical scale through the dyeing of very substantial yardages of several fabrics with various vat colors.

GENERAL APPLICABILITY OF THE PROCESS

The process has been applied successfully to cotton fabrics of virtually every type. It also has produced excellent results on rayon fabrics and on fabrics of mixed-fiber composition, such as mixtures of cotton and rayon, cotton and wool, rayon and acetate, rayon and wool, and rayon-acetate-wool.

Of particular interest is the fact that pastel shades may be applied with very uniform results. Equally important is the fact that very deep shades of vat colors may be applied without difficulty, a serious limitation of the existing continuous methods. All vat colors may be applied by this process. Experimental work also indicates that the process is applicable to the continuous dyeing of sulfur colors. It is expected also that the pad-steam technique will be useful in the application of other classes of dyestuffs to textile materials.

The new application principles utilized in this process have been applied to date only to woven fabrics. However, it is anticipated that the same basic process can be applied to the dyeing of raw stock, yarns, warps, etc., provided that the application equipment can be modified mechanically to handle the textile fibers in these forms. Active development of such extensions of the process is under way.

ADVANTAGES OF THE PROCESS

The advantages of the new Pad-Steam Process may be summarized as follows:

1. The full range of vat colors may be applied continuously in pastel to very deep shades to a wide variety of fabrics.
2. Appearance, color yield and fastness properties of dyeings obtained by this method are at least equal to the best commercial work by current methods.
3. Substantial savings in cost of color application are realized by the new process.
4. The process may be operated on long or short yardages.
5. Exhaustion problems and related difficulties in conventional dyeing are eliminated.
6. Close shade control can be obtained, even in short runs, since no boosters are required.
7. Booster baths are not used, hence the usual problems of bleeding in the boosters with attendant shade variations, establishing formulas for booster feed liquors, etc., are eliminated.

MODIFICATION OF THE PAD-STEAM PROCESS

The studies to date have indicated that under certain conditions two alternative modifications of the basic process may be desirable. In both cases, the steam fixation is retained as the basic new feature; but in each method, as indicated in the previous discussion, small liquid boosters are included in the steaming chamber. These boosters serve to modify the appearance of the dyeings, perhaps due to somewhat greater surface coloration. The auxiliary liquid boosters also tend to assist in the dyeing of fabrics which have not been subjected to thorough preparation prior to dyeing.

Following are brief descriptions of the two alternative methods:

PIGMENT-PAD, STEAM-AND-LIQUID BOOSTER PROCESS

This method differs from the basic process only in that small liquid boosters are included in the steam chamber. These boosters may be of the customary hydrosulfite-caustic-dyestuff composition, or they may utilize the principles of the du Pont Soda Ash Booster Process.

Considerable further experimentation will be necessary before definite statements can be made as to the conditions under which the auxiliary liquid boosters shall be used. Likewise, much further information is needed as to the specific effects of such liquid boosters on the appearance and fastness of the dyeings produced.

REDUCED-PAD, STEAM-AND-LIQUID BOOSTER PROCESS

This process is an application of the new steam fixation to the conventional continuous reduced-pad process. The steps of the operation are:

1. Reduced padding of the fabric.
2. Development in the steam chamber with auxiliary liquid boosters in the compartments as previously described.
3. Oxidation, soaping, rinsing and drying.

Considerable experience has been acquired in the operation of this process and the following results have been obtained:

1. Color value, appearance of dyeings and fastness at least equal to those obtained by the conventional continuous methods.
2. Excellent results with fabrics which have had little preparation prior to dyeing.
3. Substantial economies in costs of application.

The following specific example of the operation of this process is given to illustrate the method:

Cotton herringbone twill fabric s
supplied for U. S. Army clothing w
padded through a reduced vat col
bath of the following composition:

3.83 oz. per gal. Ponsol Khaki 2
Double Paste
2.05 oz. per gal. Ponsol Olive GG
Paste (Pat.)
0.70 oz. per gal. Ponsol Brown V
Paste (Pat.)
0.80 oz. per gal. Ponsol Direct Blac
3G Double Paste (Pat.)
2.75 oz. per gal. Flake Caustic Soda
3.50 oz. per gal. Sodium Hydrosul
fite
0.20 oz. per gal. Alkanol WXN

The cloth was padded at 120° F. and then led directly into a steam chamber (F) containing two small booster baths of the following composition:

3.76 oz. per gal. Soda Ash
0.94 oz. per gal. Sodium Hydrosulfite
0.16 oz. per gal. Alkanol WXN

The booster baths were placed in the second and third compartments of the steamer in order that the padded fabric should be subjected to saturated steam at 212° to 214° F. before entering the reducing liquor. The total time in steam was approximately 80 seconds, and the total immersion time in the booster baths was 40 seconds.

After leaving the steamer, the dyeing was rinsed in cold water, then in hot water, and finally soaped, rinsed and dried.

SUMMARY

New continuous methods for dyeing textile materials with vat colors have been developed. These new processes utilize steam as the fixing agent. The time required for color reduction and fixation has been decreased to a matter of *seconds*. The results obtained by these methods are equal to the best obtainable by existing processes. The choice between the basic Pad-Steam Process and the alternative methods involving liquid boosters must be made on the basis of specific mill conditions.

The growing consumer demand for the best possible color appearance and durability will result in the increased use of vat colors on post-war textiles. The new processes will facilitate the increased use of these colors not only on cottons and rayons, but also on other fibers and fiber mixtures, since the new methods provide ease of operation, produce excellent color effects, and result in low application cost.

ACKNOWLEDGEMENT

The author wishes to acknowledge the combined efforts of the du Pont Technical Laboratory and technical demonstration staffs who contributed to the successful development of these new dyeing processes.

Recent Developments in the DYEING OF SYNTHETIC FABRICS*

PAUL J. CHOQUETTE

General Dyestuff Corp.

INTRODUCTION

IT WAS my privilege to present a paper before your section on "Control in Spun-Rayon Piece Goods Processing," in 1940 (1)†. It is not my purpose to review this subject matter but rather to dwell upon the recent trends in dyeing which have been accelerated by the war and which undoubtedly will find further application in the post-war period. The concentrated effort which has been brought to bear in order to meet the requirements of our armed forces has given impetus to improved methods of dyeing. This study has also been required by the tremendous growth in the production of synthetic fibers and their application to particular end use requirements. The dyeing industry in meeting the stringent government specifications has become conscious of the importance of dyeing fabrics with colors which will meet the requirements of the end use for which they were designed. This trend toward the use of faster colors should make itself felt with increasing force in the future as our current educational programs bear fruit and should be given added impetus by our returning service men and women who have witnessed the importance of colors which stand up under the conditions of service of the fabric.

Current trends and a glimpse into the future application of the synthetic fibers in fabric design was given us at our last meeting. The dyer of the future will certainly be called upon to produce a myriad of color effects.

APPLICATION OF VAT COLORS, LEUCO ESTERS OF VAT COLORS AND NAPHTOLS TO SPUN RAYON BLENDS

The ever increasing use of spun rayons in sportswear, etc., has focused attention on the application of fast colors to this class of work. It is to be expected that the synthetic fibers should maintain the fine reputation which the vats, leuco-esters of vats and naphtols earned on the cottons for fastness to light and washing.

The vat colors may be applied by the pigment pad-jig development, pigment pad-reel development, reel dyeing, continuous reduced method, pigment pad-continuous methods. A recent development in the case of the pigment pad-jig or reel development has been the simultaneous application of a permanent finish. The vat pigment is mixed with an activated alkaline cellulose solution, padded on, followed by souring through sulfuric acid. After rinsing and neutralization the dyeing is completed in the conventional manner by reduction on the jig or reel. The pigment binding property of the coagulated cellulose film is well illustrated by the fact that no bleeding occurs when rinsing after souring and though the goods may have scrimped when batched after souring it is possible to straighten them out on the jig prior to reduction. The completed dyeing is free from streaks. This method also favors uniform development on the reel. The resultant finish is fast to washing and assists stabilization.

Spun Rayon and Wool

In mixtures of spun rayon and wool it is essential to protect the wool against the damaging action of strong alkali. Since the reaction is a function of time, temperature and pH these factors must be controlled. Good results have been obtained by the pigment-pad-jig development method on spun rayon-wool, 80:20 mixtures using trisodium phosphate 3 to 5 ozs. per gallon for the alkali, 0.6 ozs. per gallon of a protective colloid, 0.6 ozs. per gallon of glucose, 0.8 ozs. per gallon sodium hydrosulfite and 0.5 to 1.5 ozs. per gallon of anhydrous Glauber's salt at a temperature of 140° F. Selected colors should be used for this process. An alternative procedure is to reduce the normal caustic soda alkali to a minimum of 0.75 oz. per gallon and the sodium hydrosulfite at 1 oz. per gallon with 0.3 ozs. per gallon of glue as a protective colloid. Temperature 120° F. The shade should be brought up on the padder and the formulae established so that no more than six ends are required on the jig. Dyeing is followed by a passage through cold sodium bicarbonate to neutralize any free caustic soda. Rinsing, oxidation, souring with acetic acid, and soaping with a synthetic detergent completes the operation. In the case of certain fabrics, reel scouring may be preferred in order to improve the hand. The completed dyeings by both methods show excellent fastness to light and washing.

Vat reel dyeing was developed as a result of the demand by the armed services for fast colors on knit goods which must be handled in the kettle. Dyeing may be conducted by either the pigment or reduced methods. In the first case the pigment is applied to the material in the kettle using a penetrant, salt and acetic acid as assistants, temperature 160° F. This is followed by the addition of caustic soda and sodium hydrosulfite at 160° F. at which temperature the dyeing is carried out. Rinsing, oxidation and soaping follow in the conventional manner. In the case of the reduced method, the reduced dye is added to the kettle the liquor of which has been sharpened with caustic soda and sodium hydrosulfiite. Temperature 130° F. The dyeing is completed in the conventional manner. For goods which can be padded, the simultaneous application of vat pigment with activated alkaline cellulose solution, followed by souring prepare the goods for subsequent kettle dyeing.

Continuous Methods

The requirements of the armed forces have accelerated the development of improved continuous methods for the application of vat colors. The continuous reduced method has been well established for the production of light to medium shades. Recent work would indicate that heavier shades can now be successfully run. One of these processes is the pad-steam method which Dr. Meunier has just discussed. Other work has been done on a new patented machine (2) which operates at high temperatures in a very short confined aqueous medium and produces rapid fixation of color in a matter of seconds. The treating fluid follows the vat pigmented material in an even manner through narrow channels and in close contact, resulting in a uniform reaction on all sides. Heated baffles maintain constant temperatures and economy of chemical consumption results from minimum exposure to air. The possibilities of the future in the development of these concepts may well revolutionize our present

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* Presented at meeting, New York Section, January 12, 1945.

† Figures in parenthesis refer to references at end of paper.

dyeing procedures.

Leuco-Esters of Vat Dyes

The leuco-esters of the vat dyes are particularly well suited for the production of fast shades on spun rayon and spun rayon-wool mixtures. Inasmuch as the dye is in a soluble state when applied it penetrates very well and the bath has good stability. The dye is padded on with the addition of 0.5 to 1 oz. per gallon of sodium nitrite and developed by running through 0.5 to 2 per cent by volume sulfuric acid 66° Bé. Temperature 120° to 160° F., rinsed, neutralized and soaped. Since the development is a matter of seconds the process is best operated continuously though jigs can be used. For work which is preferably handled over the reel a small open width developing box can be utilized in front of kettles through which the cloth passes after padding to be followed by rinsing and soaping in the kettles. Spun rayon-wool, 80:20, give excellent results by this process. With higher percentages of wool the fastness to light may be somewhat impaired due to the slight yellowing of wool by nitrous acid. In such cases, it is necessary to modify the process utilizing ammonium persulfate as the oxidizing agent. The leuco esters of vat dyes may also be dyed on spun rayon and spun rayon-wool mixtures in the kettle. The dyeing is conducted at 110° F. with additions of salt depending upon the substantivity of the color. A wetting out agent is used to assist penetration and a protective colloid added prior to oxidation to disperse any oxidized color which may remain in the bath. In the case of the Blue IBC type it is necessary to use a small amount of ammonium acetate or acetic acid to exhaust the color. In all cases sodium nitrite and sulfuric acid are used for oxidation, the process being completed in the one bath. This method is best adapted for light shades and for materials which cannot be handled in the open width.

The leuco esters of vat colors may also be applied in combination with the activated alkaline cellulose solutions thus combining dyeing with a permanent finish. The color, required amount of sodium nitrite and cellulose solution are padded on and immediately coagulated and oxidized by passage through sulfuric acid.

It is expected that the use of these colors will increase with new additions to the already quite complete range of dyes. Ease of application with resultant labor savings will fit them into the future era of streamlined production.

Naphtols

The naphtols offer no difficulty in their application on spun rayon piece goods and can be utilized to produce dark shades including browns, reds and yellows. They may also be considered for the dyeing of spun rayon and wool blends of similar shades requiring particular fastness properties. In order to protect the wool it is necessary to reduce the caustic soda to a minimum (slightly over the theoretical) and where necessary trisodium phosphate or similar inorganic alkali should be used to maintain a stable naphtol solution. The pH of the bath should be 9.6 to 9.7. For the sake of a more even coverage on rayon and wool it is advisable to impregnate warm or hot according to the naphtol used. For example, non-substantive naphtols having lower affinity for the rayons than the substantive types dye more evenly and uniformly. Good results can generally be obtained by impregnating at 100° F. The substantive naphtols, on the other hand, have a very high affinity for rayon and as a rule exhaust very rapidly when dyed cold. Hence it is adviasble to increase the temperature to around 130° F. or higher in order to retard the affinity for the rayon. Color salts should be selected which do not stain wool or otherwise developing should proceed in an acetic acid bath buffered with sodium acetate.

DYEING OF HIGH TENACITY RAYONS

The requirements of our armed forces for tire cord, flare chutes, etc., has greatly expanded the production of the high tenacity rayons with their unusually high tensile strength. Due to the alteration of the physical structure of the filament in stretch spinning the affinity for dyestuff has been greatly reduced. This reduction in the case of the viscose types (Tenasco, Fiber G,) is approximately 25 per cent and for the saponified acetate types (Fortisan, Fiber B) approximately 70 per cent as compared to the regular viscose rayon. For intermediate or medium high tenacity viscose types the dye affinity can be considered equal to that of the regular viscose rayons.

Good results may be obtained for dark shades on the high tenacity rayons through the use of naphtols. The affinity of the naphtol for the fiber is approximately the same as for cotton though they exhaust and couple more slowly. In all cases stronger dyeings are obtained by naphtolating at 180° F. The developing and after treatment are carried out in the normal way as for cotton with the exception that the time is increased. The fastness to washing and light are very good. In the case of Fortisan (saponified acetate type) the fastness to crocking is slightly poorer. This is the subject of further investigation.

Vat Colors

The vat colors give good results on viscose high tenacity rayons but have poor affinity for Fortisan. It is possible to improve the yield by 40 per cent on the latter through the use of swelling agents but further improvement would have to be made before considering the method as satisfactory.

DYEING OF CELLULOSE ACETATE

Renewed consideration has been given to the dyeing of faster colors on cellulose acetate. This interest has been particularly evident in the case of blues and violets, so many of the desirable acetate rayon dyes in these shades being subject to gas fading. Acid colors of good fastness properties have been successfully applied to acetate rayon yarns through the use of a patented solvent or acid swelling process (3). These principles can be applied to the successful application of acid colors to acetate rayon piece goods. The leuco esters of vat colors also offer interesting possibilities along this line. The acid colors are padded on in a 30 per cent formic acid solution cold, batched, rinsed with cold water, neutralized and soaped. In the case of the leuco-esters of vat colors the acid padding is followed by oxidation with sodium nitrite and sulfuric acid. The dyeings produced have good fastness to light, washing and gas fading.

Several methods have been considered for the application of vat colors. *1. Pigment pad, saponify and dye on the jig.* In this case, after padding, the cloth may be run two ends through the normal amount of caustic soda used for dyeing at 140° F. after which the bath is tested and an additional amount of caustic soda added to compensate for that used up in saponifying the acetate. Sodium hydrosulfite is then added and the dyeing completed in the normal way. Inasmuch as the acetate rayon is completely saponified all colors may be used for this process. *2. Pigment pad-jig develop through the use of ethylene diamine and ammonia as alkali, butanol as a swelling agent and sodium hydrosulfite. This method* leaves the acetate unsaponified and is adaptable to acetate rayon fabrics only, inasmuch as viscose rayon will dye lighter. Selected colors must be used and care taken to complete the oxidation after dyeing. Fastness to light and washing are good. *3. Continuous Methods.* For light shades consideration may be given to the reduced vat method. The reduced dye, 0.75 per gallon caustic, 1.3 oz. per gallon sodium hydrosulfite, 4 ozs. per gallon butanol is padded on followed by a passage through soda ash and sodium hydrosulfite, rinsed, oxidized, soured and soaped in a neutral bath. Saponification is nil. For heavier shades the vat pigment may be padded on, dried and then passed through a solution of caustic soda and sodium hydrosulfite. This is immediately followed by a short steaming, rinsing, oxidation, souring and

soaping. The acetate rayon in this case is partially saponified, approximately 2.0 per cent, based on loss of acetyl group.

Naphtols

The naphtols offer interesting possibilities in their application on acetate rayon. The fastness to washing, cross-dyeing and crocking are good. The fastness to light is inferior as compared to cotton. However, through the selection of suitable combinations, shades of red, yellow and brown of good fastness to light may be produced. The older methods were based on application of the naphtol and base in the same bath through the use of a mild alkali such as ethylene diamine with alcohol or a small amount of caustic soda buffered, if required, with sodium acetate. After dyeing for 15 minutes at 140° F., the diazotization followed with urea and a protective colloid to aid stability. Temperature 70° to 140° F. Recent work would indicate that satisfactory results may be obtained by first exhausting the naphtol on the fiber with the aid of urea, butanol and salt and then developing with the fast color salt. The yield is good and shades consequently are economically produced.

DYEING OF CASEIN FIBER (ARALAC)

Aralac, the domestically produced synthetic protein fiber made from casein may be dyed in the form of staple fiber or tow with wool dyes, usually acid colors. Improved fastness to washing is obtained through the use of the metallized acid dyes. Piece goods woven from spun rayon-aralac blended yarns are commonly colored with direct colors with small additions of suitable acid dyes to shade the Aralac. As in the case of wool, precautions should be taken in the preparation of Aralac for dyeing, that is avoiding the use of strong alkali. Scouring with disodiumphosphate and a synthetic detergent at 170° F. give good results. After dyeing the material should be soured with acetic acid to remove traces of residual alkali.

COLORING THE VINYON POLYMERS

The dispersed acetate rayon dyes give the best results in the dyeing of the vinyl fibers. Dyeings have good fastness to washing but are apparently poor to light. The affinity of the dye varies with the composition of the vinyl polymer. Thus in the case of a polymer of vinylidine chloride (Saran) excellent yields of certain acetate rayon dyes were obtained, whereas the same dyes yielded inferior results on a copolymer of vinyl chloride and acetate (Vinyon). The temperature of dyeing must not exceed 150° F. as otherwise shrinkage of the fabric occurs. Phenol derivatives were found to improve the yield obtained when processing the poorer dyeing polymers.

GLASS FIBER-PIGMENTED

Color may be applied to glass fabrics by means of resin-bonded pigments. Uniform shades of excellent fastness to light, water and dry cleaning have been produced by padding on the highly dispersed pigment in combination with a co-dispersed resin. Since the dispersed pigment and resin are both soluble in water no inflammable solvents have to be added and the pigment pad liquor consists of water exclusively in addition to the pigment preparation itself.

DYEING OF NYLON

Nylon, because of its protein-like structure and close resemblance to silk, can be dyed with most classes of dyes.

Acetate Rayon Dyes

The dispersed acetate rayon dyes as a group exhibit excellent dyeing characteristics on nylon. They have the property of penetrating and leveling well and building up in the dye bath in dark shades. For the future extensive use of nylon, however, they lack fastness to washing. Even in the case of hosiery where they have been extensively used the trade frequently reports excessive loss in shade after ten washings. In addition many of these dyes tend to be much duller on nylon than on acetate, this being particularly true of bright orange, scarlet or red shades. Whilst this dullness is not important for hosiery it would be for ladies dress goods.

Acid Dyes—Acid, Metallized Acid, Chrome

Recent studies would indicate that selected acid colors will produce a good range of shades of improved fastness to light and washing. The selection of dye is very important for in general it may be stated that dyes which show excellent fastness to light on wool may be poor on nylon whereas dyes which are poor on wool may be very fast on nylon. (4) Care is also necessary in the selection of dyes for combination shades inasmuch as each dye has a distinctive saturation point and this property must be balanced with the varying speeds of dyeing. Fortunately it appears that dyes which have the best affinity for nylon also have fastness to light equal to or better than on wool.

The straight acid dyes may be used to produce a range of shades including the bright scarlets and reds of good fastness to washing—(AATCC No. 3) and light (40 hours in Fadeometer and better). They may be applied with 3 per cent formic acid (based on weight of goods) at 190° F. for 45 minutes. In practice they may be applied on the jig or as an adaptation of printing technique by padding and ageing (steaming).

Metallized Acid Dyes

Excellent results have been obtained through the use of metallized acid dyes particularly for medium shades. Improved fastness to light and washing are noted. A medium shade when exposed to the sun showed little or no break whereas the light standard No. 6 was badly broken. This shade would rate No. 7 and was far superior to the same dyestuffs on wool. The fastness to washing was also very good, showing only a small change after three washings (AATCC No. 3).

Practical Application

The lighter weight fabrics could undoubtedly be dyed in the kettle but for heavier constructions, that is 3 ozs. and up, jig application would be required in order to avoid streaks due to creasing.

Jig Method

The metallized acid dye may be applied directly in the jig, or by the pad-jig method. The dyeing should proceed for 2 hours for a heavy shade with a suitable penetrant of non ionic composition and 6 per cent or more formic acid (based on weight of goods). Temperature from 190° F. to the boil. For the best fastness to washing, the shade is dyed slightly on the heavy side and after rinsing is scoured at 200° F. with soda ash and a synthetic detergent. Improved penetration and faster rate of dyeing emphasize the importance of maintaining the maximum dyeing temperature. This fact has been confirmed by microscopic cross-sections of the fiber showing improved penetration at the higher temperatures.

Chrome Dyes

Acid chrome dyes of excellent penetration on nylon may be obtained. Shades of brown, navy blue and black are of particular interest. One of the disadvantages of this method lies in the difficulty of chroming. A much longer time of chroming is required than on wool; in fact many dyes never reach the complete shade. The dyeings are conducted as for acid colors at 190° to 200° F., exhausting with formic acid and afterchroming with 3 per cent bichromate. The time of chroming may extend to 2 hours.

Vat Dyes, Leuco Ester of Vat Dyes

The vat and leuco-esters of vat dyes may be applied to nylon but unfortunately many of the best colors which are very fast to light on cotton are poor on nylon. The poor resistance of the dye to light on nylon has been attributed in part to the thinness of the dye film. Some substantiation for this is noted in the fact that the fading in the case of certain vats and leuco-esters of vats is reduced by a 40 minute pressure (30 lbs. per sq. inch) steaming (5).

Improved yields are obtained in the

case of the vat colors by operating at temperatures of 180° F. and with the assistance of swelling agents such as butyl alcohol and phenol derivatives (6).

The leuco vat esters may be applied by dyeing at 195° F. with 3 per cent formic acid (on weight of goods) for 1 hour and developing in a fresh bath with 1 per cent bichromate of soda and 2 per cent ammonium sulfocyanide, treating for 10 minutes at 90° F. then adding 1 per cent (based on weight of solution) of sulfuric acid, 66° Bé., raising temperature to 195° F. and developing for 1 hour at this temperature. Goods are then neutralized, soaped and rinsed. An alternate method is to pad, dry, steam and then oxidize.

Naphtol Dyes

The shades of the naphtols on nylon are similar to cotton but they have different fastness properties. The fastness to washing is good but normally the fastness to light is poorer. However, selected shades of good fastness to light (40 to 60 hours) can be produced by using selected naphtol (AS-TR, AS-ITR, AS-SG, AS-LB, Fast Red TR, ITR, Red B) combinations to produce reds, browns and black. The nylon is impregnated with the naphtol and base in the same bath for 20 minutes at 160° F., rinsed in cold water or salt and diazotized at 70° F. with 10 per cent muriatic acid and 5 per cent sodium nitrite. The temperature may be raised to 140° F. if there is no fear of decomposition of the developing bath. This is followed by rinsing, neutralizing and soaping at 180° F. with an alkaline synthetic detergent. The original impregnating bath is first sharpened with one half the weight of caustic as compared to the naphtol to be used plus a protective colloid. To this bath, the base previously dissolved in cellosolve (1 to 2) and the naphtol which has been dissolved with the theoretical amount of caustic soda, are added.

MIXED FABRICS

It is expected that nylon will find extensive use in mixed fabrics. The designer of the future will wish to combine its outstanding chemical and physical properties to produce a given end result. Many opportunities will be afforded the dyer to produce special color effects. Thus two tone effects could be produced through treatment of nylon yarn with dry heat in one case to reduce dye affinity and with steam or special chemical agents to increase dye affinity (6). Viscose rayon and nylon in solid shades or cross-dyes, Aralac and nylon in solid shades, acetates and nylon in solid shades will offer no particular difficulties.

It can be seen that the synthetic fibers offer unlimited opportunities for the production of colored effects. I have endeavored in this paper to indicate some of these possibilities and to stress the importance of and the probable future trend toward the use of faster colors, viz., colors which will stand up under the conditions of use for which the fabric was designed. I shall be satisfied if your interest has been aroused to a realization that come the day of victory the dyestuff manufacturing and textile finishing industry will be prepared to meet the challenge of the future era of stream-lined production.

BIBLIOGRAPHY

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[2] U. S. Patent No. 2,364,838. Apparatus for treating material.
[3] U. S. Patent No. 2,249,607. Method of Dyeing Cellulose Acetate.
[4] J. G. Grundy—Society of Dyers and Colorists, Vol. 60, No. 8, p. 205, 1944.
[5] Patent review—The Dyer, Sept. 15, 1944, Vol. 92, No. 6, p. 240.
[6] C. M. Whittaker—A.D.R., Vol. 32, No. 16, p. 335, 1943.

MEMBERSHIP APPLICATIONS

SENIOR

James M. Bennett—Chemist, Ware Shoals Mfg. Co., Ware Shoals, S. C. Sponsor: H. E. Kieffer, Jr.

Arthur W. Boesler—Chemist, Alco Oil & Chemical Corp., Philadelphia, Pa. Sponsors: A. E. Jones, J. W. Jordan.

Everett W. Borden—Dyer & Finisher, Verney Taunton Mill, Taunton, Mass. Sponsors: W. F. Gimpel, W. F. Brosnan.

Harry H. Britt—Supt. of Dyeing, Dean & Sherk Co., Inc., Lawrenceburg, Ky. Sponsors: S. Klein, G. Chabot, Jr.

Raymond B. Cashin—Dyer, Fruit of the Loom, Inc., Pontiac, R. I. Sponsors: G. C. Adams, C. I. Lakey.

William F. Connell—Asst. Supt., Enterprise Dye Works, Woonsocket, R. I. Sponsors: R. Bayer, E. J. Allard.

Louis B. Cook—Research Chemist, U. S. Finishing Co., Providence, R. I. Sponsors: J. C. Shore, L. Balassa.

Clarence S. Farleigh—Gen. Supt., Bangor Mills, Inc., Pen Argyl, Pa. Sponsors: M. M. Guertin, J. F. Rieder.

Elmer Ferrante—Supt. of Dyeing, Housatonic Dyeing & Printing Co., Inc., Derby, Conn. Sponsors: S. A. Moffitt, D. E. York.

Clarence F. Gibson — Tech. Salesman, Southern Dyestuff Corp., Charlotte, N. C. Sponsors: T. E. White, L. G. Atkins.

Alfred J. Gondyke—Salesman, General Dyestuff Corp., Providence, R. I. Sponsors: K. J. Broden, G. H. Wood.

Tommie E. Headrick (Miss) — Color Chemist & Dyer, Standard Knitting Mills, Inc., Knoxville, Tenn. Sponsors: J. L. Moore, R. D. Sloan.

George A. Jamros—Dyer, Schetty Bros., Inc., Carlstadt, N. J. Sponsors: C. Monego, W. von Bergen.

Joseph Lubin—Dyer & Finisher, Amity Dyeing & Finishing Co., Brooklyn, N. Y. Sponsors: J. H. Ciciva, W. Digrius.

William J. Morrissey—Supt. of Dyeing, Lincoln Mills, Pascoag, R. I. Sponsors: J. A. Kilcommons, M. F. Davis.

Carl Passaro—Dyer, Chemist, Housatonic Dyeing & Printing Co., Inc., Derby, Conn. Sponsors: S. A. Moffitt, D. E. York.

Lloyd H. Pope — Overseer of Dyeing, Highland Park Mfg. Co., Charlotte, N. C. Sponsors: T. W. Church, W. L. Barker.

Arthur E. Riley—Chemist, International Veiling Co., Clifton, N. J. Sponsors: L. J. Roos, A. F. Johann.

Ralph A. Travis — Overseer of Dyeing, Goodall-Sanford, Inc., Sanford, Maine. Sponsors: H. M. Hartnett, J. T. Allen.

R. H. Webb—Supt. of Dyeing, Wirsler Mills, King's Mountain, N. C. Sponsor: W. L. Barker.

Herman E. Wilde—Head of Textile Div., Merck & Co., Inc., Rahway, N. J. Sponsors: C. W. Dorn, H. E. Hager.

JUNIOR

Dorothy L. Onufer (Miss)—Textile Technician, Good Housekeping Institute, New York, N. Y. Sponsors: W. E. Coughlin, L. S. Little.

Barbara K. Webster — Textile Chemist, Good Housekeeping Institute, New York, N. Y. Sponsors: W. E. Coughlin, W. H. Cady.

ASSOCIATE

Anton E. Budner—Asst. to Director of Research, S. C. Johnson & Son, Inc., Racine, Wis.

George W. Murphy, Jr.—Supt., Cotton Spinning Mill Div., S. A. Fabrica Argentina de Alpargatas, Buenos Aires, Argentina.

Applications for transfer to Senior membership—R. V. Dugdale, J. C. Farrow, R. B. Fickinger, G. Hermann, G. W. Little, B. P. Lynam, A. W. Mack, C. W. Merritt, K. E. Traynham.

Corporate Membership Applications—Harodite Finishing Co., Inc., Jefferies Dyeing Works, Neisler Mills, Inc., Scott Testers, Inc., Westinghouse Electric & Manufacturing Co.

ONE HUNDRED AND FORTY-NINTH COUNCIL MEETING

THE Council held its 149th meeting in the Providence Engineering Society Building, Providence, R. I., on Friday morning, March 23, 1945. Present were President William D. Appel, presiding; Hugh Christison and Henry F. Herrmann, Vice Presidents; William R. Moorhouse, Treasurer; Louis A. Olney, Chairman of the Research Committee; William H.

Secretary's Financial Report — March 16, 1945

Received & Transmitted to Treasurer	*Applications*	*Dues, regular & reinstate*	*Dues, Corporate & Sustaining*	*Miscellaneous*	*Totals*
Aug. 1, 1944, to Jan. 5, 1945.....	1,587.50	12,213.50	20,369.48	5,499.32	39,669.80
Jan. 5 to Mar. 16, 1945.....	660.00	2,261.50	8,820.00	2,645.29*	14,386.79
Total in fiscal year to date.....	2,247.50	14,475.00	29,189.48	8,144.61	54,056.59
Leaving deposited by Treasurer with Secretary					2,000.00

Miscellaneous items, *		
Year books		151.25
Reporters		50.35
Reprints		6.95
Crockmeters		112.00
Crock cloth		46.00
Multifiber cloth		2,037.34
Water test apparatus		66.00
Dyed standards		12.00
Knitted tubing		51.00
Buttons		4.50
Launderometer royalties		105.00
Gas fading blue prints		3.00
		2,645.39
Less bank charge		.10
		2,645.29

Cady, Thomas R. Smith and P. J. Wood, Past Presidents; Edward S. Chapin, Harry M. Hartnett and Charles H. A. Schmitt, representing Northern New England; Howard V. King and Ben Verity representing Rhode Island; Kenneth H. Barnard, Patrick J. Kennedy, Leonard S. Little and Thomas F. O'Brien representing New York; Boyce C. Bond and James P. Conaway representing Philadelphia; Winn W. Chase, Chairman of the Publicity Committee; Bertil A. Ryberg, Associate Research Director; and Harold C. Chapin, Secretary. The Secretary's report of the 148th Council meeting and financial report of March 16, and the Treasurer's report of March 21, were accepted.

It was proposed by the Appropriations Committee, and subsequently approved by letter ballot of the entire Council, that Section 4 of Article III in the By-laws be amended by striking out the clause, "provided, however, that no securities shall be purchased except as are legal for savings banks in the Commonwealth of Massachusetts," and substituting, "provided, however, that no securities shall be purchased except such as those owned by New York or Massachusetts life insurance companies, Harvard University or the Massachusetts Institute of Technology during the past year, as shown by their annual reports, or subsequently purchased."

It was voted that the present General Fund be considered so distributed as to include three fourths of the Association's present investment in government bonds, and the Research Fund to include one fourth. It was voted that the Executive Committee for Research be authorized to spend $4000 from the Research Fund for a conditioning room and its equipment at the Lowell Textile Institute. The President was authorized to appoint a committee to consider the question of full-time Secretary and facilities, and means of financing. Mr. Herrmann reported for the Corporate Membership Committee, Mr. Barnard on the Intersectional Contest, Dr. Olney on Publications, and Mr. Little for the Executive Committee on Research. Friday, June 22, was chosen for the next Council meeting, in New York.

Elected to Corporate membership were,

Airedale Worsted Mills
American Bleached Goods Co.
American Velvet Co.
Armour & Co.
Aspinook Corporation
Dow Chemical Co.
The Harodite Finishing Co.
Jefferies Dyeing Works
Maher Color & Chemical Co.
Meadtex Fabrics Co.
Neisler Mills, Inc.
North Carolina Finishing Co.
Pfister Chemical Works, Inc.
Richmond Piece Dye Works
Riverside and Dan River Cotton Mills
Rock Hill Printing and Finishing Co.
Scott Testers, Inc.
Sidney Blumenthal & Co.
Standard Bleachery & Printing Co.
Uncas Finishing Corporation
United Piece Dye Works
Wellington Sears Co.
Westinghouse Electric & Manufacturing Co.
R. Wolfenden & Sons

Each of the following was elected to the class of membership specified, as of thirty days from publication of application, provided no objection be received meanwhile by the Secretary.

SENIOR

E. D. Altwegg
A. F. Bailey
T. Baitzel
E. J. Bartmann
J. M. Bennett
L. Bergeron
P. C. Blackman, Jr.
A. W. Boesler
A. W. Boesler, Jr.
E. W. Borden
B. Borzykowski
F. L. Bradley
H. G. Kessler
M. O. Kremers
J. R. Lalonde
F. Langford
J. A. Leach
H. Leaver
E. A. Lehninger
W. H. Leyking
J. H. Longenhagen
J. Lubin
C. J. Mann
E. R. Marthens
H. H. Britt
J. M. Buckner
R. H. Bullard
L. R. Burgess
L. A. Calcagni
R. B. Cashin
A. F. Clark
W. F. Connell
L. B. Cook
R. M. Covington
H. F. Crosby
J. P. Curtis
L. R. Custer
P. L. D'Alessandro
M. D'Argenio
P. Davis
E. J. Dupre
R. H. Eaton
C. W. Ebert
R. A. Eldridge
O. Engelhard
B. Englert
F. L Englert
W. E. Eskew
C. S. Farleigh
E. Ferrante
J. W. Fidler
G. P. Fulton
E. J. Geering
C. F. Gibson
G. E. Goheen
H. B. Goldstein
M. H. Goldsticker
L. W. Grant
F. Grosswirth
F. E. Hall
D. G. Hambrecht
T. E. Headrick
N. H. Herms
J. J. Heslin
M. T. Hoffman
C. S. Hollingsworth
A. E. Huebner
W. H. Hughes
W. B. Huntley
G. A. Jamros
D. A W. Johnson
A. Katz
E. J. Keating
M. W. McBee
G. McCall
H. R. McCleary
J. A. McDermott
C. Miller
P. H. Miller
J. A. Monthal
G. A. Morgan
W. J. Morrissey
M. S. Morrison, Jr.
E. F. Murphy
W. J Myers
E. J. Norris
W. P. O'Heir
C. F. O'Neill
W. A. O'Shea
C. Passaro
H. L. Pfluger
E. C. Pittman
L. H. Pope
H. Potter
G. W. Reading
A. E. Riley
L. Rioles
W. M. Robertson
G. Sarabhai
W. S. Sayward
A. Scholes
J. J. Scibior
D. B. Setzler
A. Smith
J. Stanley
G. B. Suhrie
T. H. Swan
C. S. Tanner
G. A. Thorell, Jr.
R. Travis
J. A. Tweed
W. B. Uhler
A. P. Vars
R. C. Walker
J. Warr
R. H. Webb
H. L. Welsted, Jr.
W. H. Weston
M. S. Whelen
R. J. Whitney
W. A. Wieland
H. E. Wilde
R. H. Wilhelm
M. M. Wilson

JUNIOR

M. E. Arbor
H. F. Forrest
A. E. Gervais
P. J. Howard
J. C. Jordan
G. L. Kentos
L. C. Kolodny
M. Kramer
V. C. Lovegreen
M. F. Miller
D. L. Onufer
E. J. Page
C. E. Pratt
M. E. Richardson
E. T. Rohrback
E. J. Shreve
D. V. Thoman
A. Viola
B. K. Webster
E. S. Wentzell
D. M. Zuckerman

ASSOCIATE

R. E. Bailey
A. Budner
F. de Leon
A. M. Frere
A. Gondyke
W. K. Griesinger
J. P. Guyer, Jr.
S. Kesslinger
L. S. Manchester
H. F. Metzler
S. R. Mistry
H. S. Mitchell
R. Molins
G. W. Murphy, Jr.
E. A. O'Neill
T. R. Probst
G. E. Schultze
M. Stancati
E. L. Taylor
S. G. Twitchell
A. E. Van Wagner
J. F. Weller

STUDENT

M. Kaplan
J. W. Merrill
P. F. Riordan
D. R. Nadeau

Transferred from other classifications to Senior membership were, R. V. Dugdale, J. C. Farrow, R. B. Fickinger, G. Her-

mann, G. W. Little, B. P. Lynam, A. W. Mack, C. W. Merritt, K. E. Traynham.

Respectfully submitted,

HAROLD C. CHAPIN,
Secretary.

—♦ ♦—

THE NATION'S STRENGTH

TO victory in the greatest and most highly mechanized of all wars our engineers and chemists have contributed no small part. Needs of the moment have drawn many from their fields of special training and usefulness into combat service. It is now time to look to the future, that we may conserve and develop talents vital to the strength of the nation in war or peace.

At our general meeting of last fall Samuel C. Lind stated that in a normal year there were about 3300 graduating from accredited four year courses in chemistry and chemical engineering in the United States; but that this was being reduced to about one tenth for three years or longer, and that this would mean a shortage of 9000 chemists and chemical engineers, or nearly three years supply in these professions alone. He further stated that reports from Russia before and during the war indicated five times as many students of science and technology as in our own country. England had taken to heart her bitter experiences of the last war, and was protecting her scientists and students of science in the present war.

In the Congressional Record of March 19, 1945, and reported with other data from the American Chemical Society in Chemical and Engineering News of April 10, 1945, is a speech by Congressman Gifford entitled, "The Crisis in Technical Manpower." Introduced by Congressman McDonough on April 2, 1945, is bill H.R. 2827, as follows.

H. R. 2827, IN THE HOUSE OF REPRESENTATIVES, APRIL 2, 1945, 79TH CONGRESS, 1ST SESSION

Mr. McDonough introduced the following bill: which was referred to the Committee on Military Affairs.

A BILL

To authorize the release of persons from active military service and the deferment of persons from military service, in order to aid in making possible the education and training and utilization of scientific and technological manpower to meet essential needs both in war and in peace.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled. That (1) in order to make possible the training, education, and availability of such numbers of persons as are necessary for the health, safety, and welfare of the Nation in the sciences of fundamental importance to the conclusion of the war, the safe reconversion of the national life to the ways of peace, and the Nation's potency in the world's future economy, the President shall, under such rules and regulations as he may prescribe, provide for the deferment from military service of—

(a) not to exceed 20,000 young men annually for training to meet essential needs in the physical sciences and in their application to technology and engineering, and of teachers to conduct said training program; and

(b) 15,000 trained scientists and engineers now employed in research or by industry in work essential to the health, safety, and welfare of the Nation.

SEC. 2. The discharge or assignment to essential civilian pursuits of—

(a) not to exceed 20,000 technically-trained enlisted men, especially chemists, chemical engineers, physicists, and mathematicians, not utilizing their highest skills in the practice of their professions in the Army or Navy, to industries and educational institutions urgently in need of such men; and

(b) not to exceed 15,000 enlisted men partially trained in those branches of science and engineering in which shortages exist, but whose collegiate training was interrupted by military service and who had shown promise of completing with distinction their preparation for professional work; providing they undertake to immediately resume and continue their collegiate training to graduation.

SEC. 3. No provision of law in force on the date of enactment of this Act shall be construed to authorize any action inconsistent with the provisions and purposes of this Act.

The Council of the American Association of Textile Chemists and Colorists endorses the objectives of this bill and recommends to the membership of the Association such personal action as they may deem appropriate to bring the situation to the attention of Senators, Congressmen and the general public.

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MEETING, SOUTH CENTRAL SECTION

THE Spring meeting of the South Central Section was held at the Patten Hotel in Chattanooga, Tennessee, Saturday, April 28, 1945.

After an informal dinner the business meeting was opened by the chairman. After a discussion about the Intersectional Contest it was voted that this section not enter the contest this year.

The chairman appointed a program committee as follows for the fall meeting: Wm. J. Kelly, Chairman, G. H. Boyd, and C. C. Cayce.

C. A. French of the Industrial Heat Engineering Co., Greenville, S. C. presented a paper entitled, "A Few Applications of Infrared Radiations in the Textile Industry."

Clyde Horne of Dixie Mercerizing Co. gave a talk which he called, "Hash." This was a very entertaining and enlightening talk on personnel relations.

There were 70 in attendance at this meeting.

Respectfully submitted,
WILBUR K. NEWMAN, *Secretary.*

MEMBERSHIP ON MAY 1, 1945

Section	*Senior*	*Junior*	*Associate*	*Student*	*Total 1945*	*1944*	*1943*	*1942*	*1941*	*1940*	*1939*	*1938*	*1937*
Northern New England	377	34	53	5	469	402	407	398	391	349	327	311	303
Rhode Island	341	25	35	4	405	348	352	341	337	332	295	284	256
New York	846	54	108		1008	817	707	651	606	538	483	451	409
Philadelphia	557	29	58		644	550	513	517	475	447	381	369	326
Piedmont	322	7	37		366	326	286	309	297	293	277	247	238
South Central	81	1	5		87	83	72	80	71	61	63	56	41
Southeastern	111	5	22	3	141	141	146	175	142	137	133	109	55
Mid West	224	9	28		261	209	198	194	193	180	157	158	147
Student Sections	1			14	14	20	56	117	80	59	51	57	41
No Section	119	52	21	7	199	151	122	82	87	80	71	65	55
	2978	216	367	33	3594	3047	2859	2864	2679	2476	2238	2107	1871
Corporate members					299	184	82	77	33	33	32	30	30
				Totals	3893	3231	2941	2941	2712	2509	2270	2137	1901

Members in the armed services are counted above only if subscribing to Reporter and Year Book.

Mills Meet Quality Demands Through

WIDER USE OF INSTRUMENTS

J. L. COBURN

Leeds & Northrup Co., Philadelphia, Pa.

WHILE still vastly preoccupied with the immense job of providing the clothing and equipment materials for our armed forces, the Textile Industry as a whole, is giving sound thought to its postwar job of supplying returning service men with mufti, of manufacturing dress goods for consumption both here and abroad, and for providing textiles for the homes, cars, planes and trains of the postwar world.

The great amount of constructive thinking that has been done on this subject is clearly reflected in the results of a recent survey. Over 200 representative mill men, selected at random, were asked to describe those problems which were giving them the most concern. A tabulation of the answers showed that they fell into 16 main groups, of which three stand out as being the most often given . . . (1) the problem of maintaining mutually satisfactory relations with labor, cited by three-quarters of the men; (2) the problem of replacing worn-out and obsolete manufacturing facilities, cited by two-thirds of the total number; and (3) that of reducing manufacturing costs, cited by almost as many. It soon becomes apparent that these three bear a close relation to each other, for satisfactory labor relations and low manufacturing cost seldom can be attained without modern equipment.

But what can a mill owner or superintendent do today to get a jump on this postwar problem . . . to strengthen his company's ability to compete successfully in the years following the war?

To fill tomorrow's need *today*—and at the same time meet today's increasing demands easily and effectively, many measuring and controlling equipments, to be described in this article, are being applied to textile machines now in operation. They are improving processing at present and, when new machinery can be bought, will transfer to it readily, to produce a more uniform product . . . to force down costs. Their use saves time and raw materials—reduces waste by cutting down the number of rejects and "seconds."

In addition, where instruments are installed *now*, workmen become thoroughly familiar with them long before competition tightens. Because the information they provide is a substitute in some cases for the knowledge gained only through years of experience, mills which have modern equipment usually have more efficient workers. Operators can do more varied types of work. They don't have to spend valuable time taking grab samples. And laboratory men, too, begin adapting to their purposes the new raw materials which will be available to the textile market in the postwar period.

Let's look at some of the phases in textile manufacture where workman and lab worker alike can "sharpen" their senses —can work more effectively. Some of the instruments we will consider are familiar "tools" in the more progressive American mills; others, long used in many industries, are just now being recognized for what they can offer the textile plant.

WATER SUPPLY CONTROL

Instruments and equipments which measure or control the composition of the water used in so many diverse ways throughout the textile mill are of special interest to plant owners and superintendents. They know how much water is used in textile finishing alone, where the average fiber spends 80 per cent of its processing time in a wet state. They know that when even a small mill uses a million gallons of water a day, equipment which helps every phase—processing, dyeing, or washing—is important.

That is the reason why many mills use continuous recording equipment to measure the pH of the plant water supply. If desired, this equipment can control the pH of the water from the time it leaves stream, lake, or well, until it reaches tank or boiler as finished water. Because it is seldom that raw water can be used for processing or washing purposes—necessitating water treatment in order that soap and dyes work well and in order to avoid iron, manganese and organic staining—accurate and continuous recording and control of plant water has outstanding advantages.

pH AUTOMATIC EQUIPMENT

The equipment used often consists of a glass electrode assembly electrically wired to a recording instrument. As the water or process solution passes through the electrode assembly flow chamber, the electrodes set up a voltage, proportional to pH, which is continuously measured by the sensitive balancing mechanism of the recorder. Of a potentiometer-type, this instrument—often a strip-chart or round-chart Micromax—employs the familiar and basic electrical-balance method appropriately modified and adapted to pH measurement.

Where this equipment is installed, there is no running of grab samples, no delay. There is no period when pH is unknown, for if there is a departure from the specified value, it is promptly noted by the recorder. Simply by glancing at its indicating scale, the operator can see at any moment any deviation from the desired pH value. For further reference he has a continuous record drawn on the instrument chart, which is calibrated directly in pH units. In many plants, the instrument also controls pH automatically through the use of drive mechanisms which promptly open or close the necessary valves, taps, or drains.

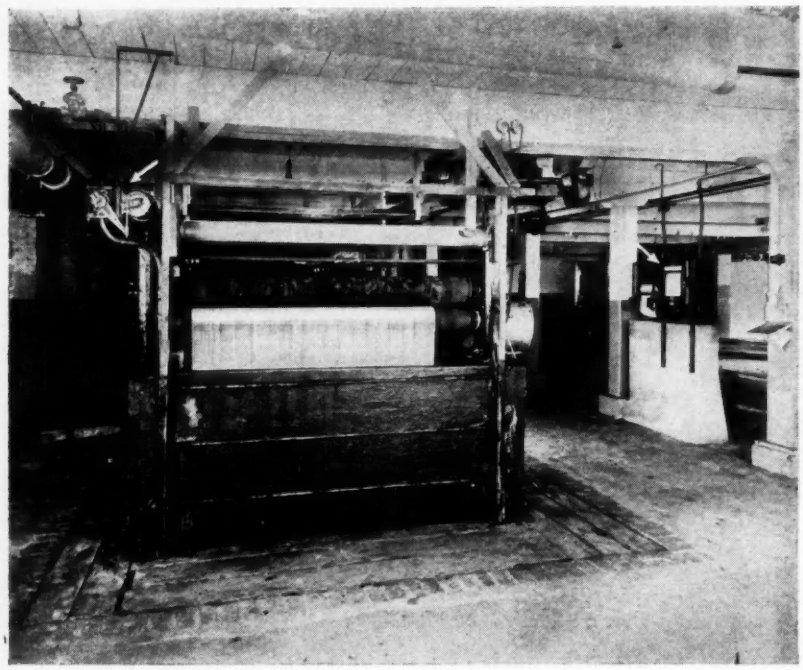
WASH-WATER CONTROL

These same pH instruments provide similar advantages wherever water is used in textile mills. Indeed, many manufacturers who must wash their products to remove reagents are now determining the end point in a washing operation through the use of this pH recording or controlling equipment.

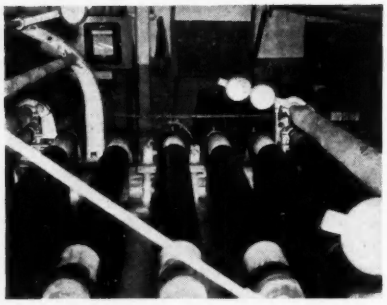
For those washing operations where conductivity is the direct function of the reagent used, electrolytic conductivity equipment has been extremely satisfactory. Through its use, water savings as high as 30 per cent have been reported.

ELECTROLYTIC CONDUCTIVITY EQUIPMENT

The electrolytic conductivity of a solution may be recorded or controlled by equipment which is similar to that used to determine the pH of a solution, but with necessary modifications in the type of cell and recorder used. Immersed in the liquid is a glass conductivity cell assembly. Any difference between a standard electrolytic conductivity cell and a cell through which the process liquid constantly flows is continuously measured by the recorder. Simply by glancing at a moving chart, calibrated directly in resistance or conductance, the operator can see, at any moment, any deviation from the desired concentration. In some plants, the recorder is equipped to regulate a motor-operated valve in the reagent feed-



Acid and alkaline baths are being held automatically to the specified strength by equipment which controls the electrolytic conductivity of the solution. In the installation shown, a Micromax Controller (arrow at right) combares and records the difference between the findings of a reference and a measuring cell, both immersed in the solution. In addition, whenever the ratio reaches a predetermined point, the Controller adjusts a motor-operated valve (arrow at left) to regulate flow of reagent accordingly.



The strength of this carbonizing bath is being held uniform through the use of Micromax Conductivity Control equipment at the Botany Worsted Company. Shown immersed in the bath are the conductivity cells which detect the bath concentration . . . mounted on the wall at left are the Controllers which automatically direct the opening or closing of the acid feed valves.

line . . . to hold bath strength uniform.

The recorder used may be one of the models described under pH measuring equipment, or it may be a multiple-point Micromax which records conductivity of one cell after another at intervals of about one a minute. Where constant indicating and recording are not necessary, but where frequent periodic checks are needed, Micromax manual indicators, panel-mounted at any convenient point, are often used.

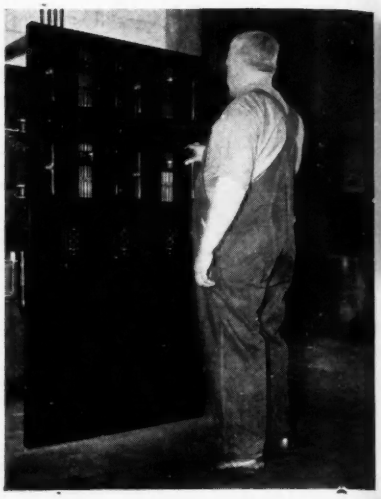
PROCESSING REGULATION

Many processes which ordinarily demand frequent testing to determine acid and alkaline strength of baths, the length of washes, are responding reliably to this conductivity control. Now operating in many plants where continuous, exact information saves valuable time and material, and allows operators and chemists more time for other duties, the success of these controls is indicative of their dependability, accuracy and adaptability.

In the important processes of carbonizing and mercerizing, for instance, increasing numbers of manufacturers are finding that acid baths are being held to more uniform strength, where electrolytic conductivity equipments measure and usually control the bath. It has been found that under such control, less acid is used . . . color is more "level" . . . bath strength reaches a uniformity which the best operator cannot equal.

pH MANUALLY-OPERATED EQUIPMENT

While for most applications it is desirable to have continuous and automatic recording or controlling of pH in textile mills, there are some places where intermittent measurements are satisfactory. For example, in measuring the pH of dyes, process waters, oil emulsions, bleaches, and other solutions which do not require continuous recording, operators are finding portable indicators to be reliable guides.



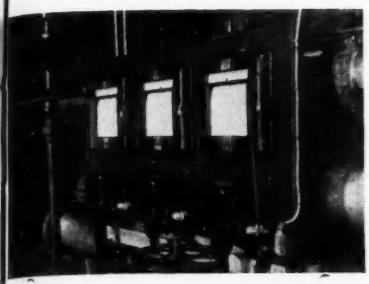
From this compact Combustion Control panel, three 150 hp. stoker-fired boilers are operated. Conveniently arranged are a Master Controller, three Furnace Pressure Controllers, and three control stations. With the instruments so centralized, an operator can switch from full automatic control to base load control or to push-button control—can suit the operation to plant requirements. This flexible, all-electric system is primarily for use where metered control isn't justified . . . as in smaller mills.

A glass-electrode indicator which is in common use is one which permits the operator to measure small samples without removing the self-contained electrodes from the case . . . to read pH directly from the deflection-meter scale. This indicator operates at full accuracy in atmospheres of 95 per cent relative humidity, and is effectively shielded from ordinary electrical disturbances. Although it does not provide the high accuracy of a potentiometer, its limit of error is ample for routine measurements.

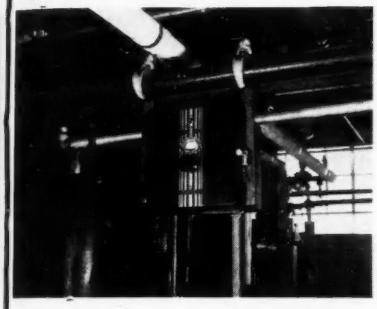
Where more accurate pH measurements are needed, either in plant or in laboratory, portable Universal pH Indicators of the potentiometer type are frequently used. These instruments combine sensitivity with speed and convenience. Most operators find them as easy to use as glass electrode indicators. Usually they are supplied for direct-reading, not only with their own self-contained glass electrode, but also with quinhydrone, hydrogen, or any electrode following the Nernst equation.

FOR CONTINUOUS MEASUREMENTS OF SPEED

Recently, the more advanced among the textile makers—especially those concerned with the manufacturer of rayon and various synthetic fibers — have realized that testing the speed of their



Located in the filter plant of a New England textile mill, these three Micromax pH Recorders show, left to right, the pH of finished water at the clear well, pH just after alum and filters, pH of water coming into plant. The flow-type glass pH electrodes are shown mounted in metal boxes directly beneath their respective recording instruments.

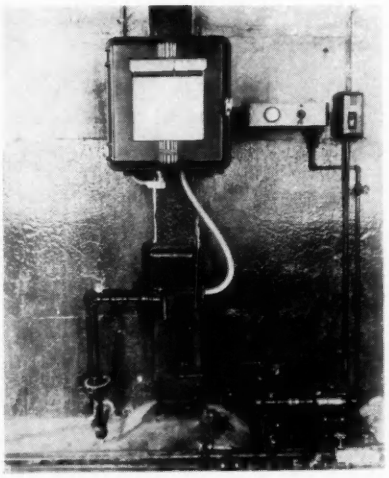


In many plants, condensate from process heaters goes directly back to the boiler feed supply only after its purity has been passed on by a Signalling Conductivity Controller shown above. If the equipment's cell detects any impurity in the condensate, the controller opens a valve, rings an alarm, and runs the offending fluid to waste.

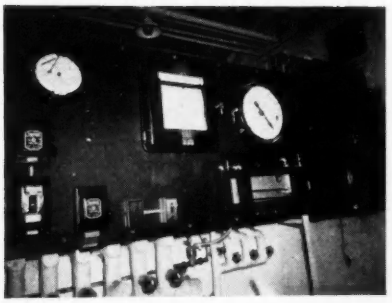
machines intermittently is not enough. To obtain an accurate guide at all times, they are relying on speed recorders. A tachometer mounted at the gear train usually is used with a recording instrument, which continuously measures and records speed directly in rpm, feet per minute, meters per minute or other units. Users of these speed recorders report that they are able to achieve both top output and high quality.

FOR MEASUREMENTS OF TEMPERATURE AND HUMIDITY

Because the temperature of drying, the humidity of drying air, and the rate of drying affect the ultimate strength and lasting qualities of textile fibers, accurate knowledge of these conditions is essential. While, in some mills, the temperature of dryers and dye vats is detected by thermocouples, the fact that these temperatures usually are low has led the majority of plants to use Thermohms. The recording instrument to which these Thermohm detectors are connected is a standard Micromax . . . usually a multiple-point re-



When pH equipment such as that shown above is used, operators have an accurate guide to how efficiently they are adding reagent. Any departure from specified pH is promptly detected . . . is continuously indicated and recorded. Here mounted directly beneath a Micromax Recorder is the detecting element, a glass elctrode assembly, through which a sample of the solution constantly flows. This installation is in one of the plants of the Texas Company.

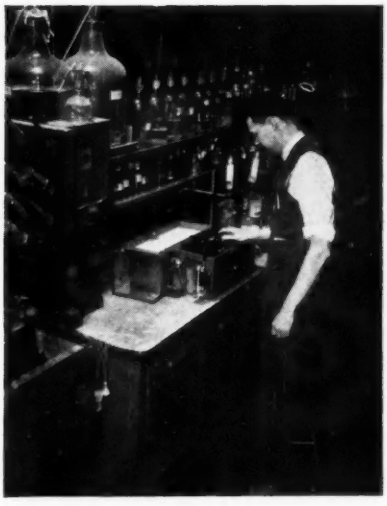


On this rayon drier in the experimental lab at the Ohio State University, the Strip-Chart Micromax Recorder is printing successively temperatures detected by seven variously located thermocouples . . . the Round-Chart Wet-Dry Bulb Temperature Recorder gives a clear index and daily record of other drier temperatures.

corder. It embodies a Wheatstone bridge circuit and is equipped to measure temperatures detected at as many as 16 different points . . . indicating them clearly and providing large-scale, detailed records.

Air-conditioning—so necessary in the manufacture of such products as carpet wools, mercerized cotton, and acetate rayon—is regulated efficiently through the use of Thermohm indicators and recorders. They show, at one central location, temperatures being detected in rooms, air-ducts, and waterlines in all parts of the plant . . . an invaluable aid to the operator. Multiple-point instruments are widely used for this applica-

Outstandingly rapid and convenient for pH measurements and for titrations, this simple Glass-Electrode pH Indicator is stripped to essentials for low cost and for easy operation. For measuring small samples the self-contained electrodes do not have to be removed from the case. Light in weight, the set includes everything necessary for measuring pH with an accuracy sufficient for many lab measurements and ample for practically all plant checking.



A direct-reading instrument which can be used with glass, hydrogen, or quinhydrone electrodes, this portable Universal pH Indicator offers outstanding advantages. It combines the accuracy and sensitivity of a laboratory instrument with the speed and convenience needed in a portable indicator. It is entirely self-contained . . . measurements are made without removing the sealed electrodes from the compartment. The whole instrument is built for lasting reliability.

tion. Sometimes they are supplemented by other Micromax instruments which record both wet and dry bulb temperatures, or those which record relative humidity directly.

IN TEXTILE LABORATORIES

For the lab worker, too, instruments are of increasing importance. Some of these must be simple enough to enable him to make intermittent, routine tests of plant processes—others must be precise enough for use in research.

To make electrolytic conductivity measurements in the laboratory, for example, operators often employ a rather simple a-c Wheatstone bridge, of a type which can be used also for many measurements other than conductivity. For measuring conductivity exclusively, portable electrolytic conductivity indicators are preferred by many workers.

For measuring temperatures detected by Thermohms, d-c temperature bridges are widely used. When the detecting element is a thermocouple, ordinary measurements are made with portable indicators; more precise measurements with potentiometers.

For measuring pH, lab workers are depending on the glass-electrode indicator and the universal pH indicator, previously described.

IN TEXTILE POWER PLANTS

Not alone in the processing departments and in the lab is good instrumentation proving its worth, but also in the power plant. For example, where condensate from process steam is returned to the boilers, the same electrolytic conductivity equipment, previously described for process applications, is also being used to record feedwater purity. The condensate constantly flows through the instrument's detecting cell; just as soon as a coil leak puts a trace of impurity in the water, the controller opens a valve, rings an alarm, and runs the contaminated water to waste.

It is helpful, too, to have a continuous record of the amount of CO_2 in the flue gas. In many power plants this is being provided by equipment which employs the thermal conductivity method. To show on one chart, legible records of the temperatures of steam, gas, air and water, multiple-point recorders are used. Many power plants are obtaining the operating and service advantages of constant frequency, where frequency controllers are installed.

Combustion control has also been applied to many boiler furnaces in the textile industry. For most textile power plants, which are of modest size, a simple, all-electric system of combustion control provides the type of regulation needed to keep steam pressure at the desired level. These electric systems continuously proportion the flow of fuel and air to the boiler, and at the same time, regulate furnace pressure. For those few larger plants where it is considered advantageous to employ a full metering type of combustion control, a pneumatic-electric system often is used. It performs all the functions of the all-electric system, and in addition, makes available all the features of a full-metering system of control.

Here, then, is an answer to that practical question which numerous executives are asking, "What can we do now to prepare for the future?" Here are equipments which are already available to the textile industry. They are in ever-increasing demand. Even today, the high standards which will be met in the post-war competitive market are being foreshadowed by such innovations as the "Statistical Quality Control" now being employed by the U. S. Army Quartermaster Corp. Undoubtedly, this trend toward standardization will continue, even with the end of the war. For meeting such demands, modern equipment will be a necessity. For handling the new products and new problems caused by the war and the changes that are to follow it, there will be no "rules of the thumb" which some operators now follow . . . modern equipment will be a necessity.

MILDEWPROOFING

VICTOR P. GIDDINGS, JR.

Materials Engineer, Office of the Chief of Engineers

IN the Spring of 1941, the Corps of Engineers, realizing the importance of rotproofing and mildewproofing treatments to the successful use of textile fabrics under the varied field conditions encountered in a global war, began an extensive research program on the evaluation of fungicides and their application to textile fabrics. The primary purpose of the investigation, at that time, was to find suitable preservative treatments for sandbag fabrics. It was anticipated that, in the event of war, tremendous quantities of sandbags would be required to meet the demands of the Army, Navy, and Office of Civilian Defense. The procurement of these bags would be a responsibility of the Corps of Engineers.

The Engineer Board, Fort Belvoir, Virginia, which normally does the experimental and laboratory work for the Corps of Engineers, was not equipped to conduct mycological or bacteriological tests. It was, therefore, necessary for the Office, Chief of Engineers to locate and organize other Government Laboratory facilities to conduct the tests necessary to this work. In surveying the existing facilities, it was found that the Bureau of Agricultural Chemistry & Engineering of the Department of Agriculture was well equipped to conduct soil burial and outdoor weather exposure tests and that all other tests could be admirably conducted by the National Bureau of Standards.

In view of the urgency of obtaining results with some immediate practical value, as well as those of a more purely scientific nature, it was necessary to select a series of highly accelerated tests which, it was hoped, would predict the relative effectiveness of the treated materials under long outdoor exposure. Since the development of treatments for sandbags was the immediate problem, tests were selected which would duplicate in an exaggerated way the field conditions under which sandbags would normally be used. Sandbags are filled with soil, oftentimes rest on the soil and are frequently wet or damp on one or more sides. The upper layer of bags in use is exposed to sunlight and rain, and to mold and other infection through airborne micro-organisms. The soil filling and foundation, of course, provides fertile sources of infection by cellulose decomposers and other molds and bacteria.

It was, therefore, quite natural that soil burial was selected as one of the evaluation tests. Acceleration of the test was obtained by using a composted "greenhouse" soil composed of sand, loam, and horse manure. Fabric treated with 1.0 per cent metallic copper in the form of copper naphthenate was run in the soil beds as a control on the treatments under test. Twelve weeks was selected as the test period on the assumption that this period of soil burial would represent approximately two (2) years of average outdoor exposure to soil infection.

The reason for choosing outdoor weathering as an evaluation test is obvious. During the outdoor weathering tests

breaks were made on the specimens at 1-month, 2-month and 6-month intervals. Outdoor exposure and soil burial tests were conducted by the Southern Regional Research Laboratory at New Orleans, Louisiana.

Laboratory tests conducted by the National Bureau of Standards were intended primarily to check the stability of the treatments used against leaching, decomposition by light or heat, and loss of fungicidal properties due to any of the above causes.

These tests consisted of inoculation with Chaetomium globosum before and after accelerated weathering; leaching; heat stability; and copper and zinc analyses when applicable. The Chaetomium test, as originally used, was a 14-day test followed by breaking strength determinations. It was later found, by experience, that the 7-day visual method would serve the same purpose in one-half the time. The accelerated weathering test consisted of exposing the samples in an Atlas single arc Weatherometer for 360 hours. The fabrics on which the various treatments were applied for test purposes were those which would be used for sandbags,—7 oz. cotton osnaburg and 10. oz. jute burlap. The treatments were applied by the commercial firms who submitted them for test, using production scale applications wherever possible. Three-yard treated samples were obtained from the manufacturer and were divided equally between the National Bureau of Standards and the Southern Regional Research Laboratory for the tests described above.

Immediately following the outbreak of war, tremendous quantities of treated sandbags were put under procurement. The treatments used were those that had shown most promise in the testing program as of that date. The merits of the copper compounds, as a class, had become apparent even at that time. Copper naphthenate, cuprammonium, and copper ammonium fluoride appeared to be the most satisfactory of the copper compounds.

In order to insure uniform application, correct quantities of the treating compounds, and to control other qualities of the treated materials under mass production methods, samples from each 40,000 yards of material processed were taken and tested at the National Bureau of Standards for full compliance with the specification. The information gained through this procurement testing during a period of two (2) years was found to be of great development value and was utilized in revising and strengthening the specification.

U. S. Army Specification No. 100-17 was arrived at by these methods and offers in brief form the results gained through both the research program on the evaluation of rotproofing treatments and the experience and information gathered through the procurement testing of approximately 250,000,000 yards of treated sandbag fabrics.

Outdoor service tests on actual sandbags treated with the compounds covered by U. S. Army Specification No. 100-17 and other treatments have been under way for some time at the Southern Regional Research Laboratory, New Orleans, Louisiana. Preliminary results on these tests confirm, in general, the rating of the treatments by accelerated methods. Some differences in the relative standings of the three (3) copper treatments are indicated, and other copper compounds such as copper tallate, copper oleate, and copper resinate show up better than they did in the accelerated tests. The addition of creosote to copper napthenate and other copper treatments seems to greatly increase their service life on outdoor exposure tests.

The Corps of Engineers is now conducting a research program to determine the most effective methods of treating fabrics for protection against surface growing molds which, though not cellulose decomposers, may destroy the coating of a coated fabric to such an extent as to invite attack of the fabrics themselves by molds and micro-organisms of the cellulose decomposing types.

TRADE NOTES • NEW PRODUCTS

OBITUARY

ALEXIS SOMMARIPA

ALEXIS SOMMARIPA, of Millwood, Va., a leader in the field of rayon fabric development, was killed in action on March 28 while serving in Germany as a civilian member of the Psychological Warfare Detachment with General Patton's Fourth Armored Division, the War Department announced recently. He had just received the bronze star for outstanding bravery in capturing 1,200 Germans.

Mr. Sommaripa, who went overseas with the Office of Strategic Services in February, 1944, first served under General Hodges. He joined the O.S.S. in 1942 and trained at Camp Lee, Va., after a year with the War Production Board in Washington.

Born in Odessa, Russia, in 1900, he was graduated from the Imperial Law School. He came to the United States in 1920 and studied at Harvard Business School. After graduation, he worked for a while with Nashua Mills, Nashua, N. H., inventing a fabric processing machine which was patented and has been widely adopted.

Mr. Sommaripa was employed by E. I. du Pont de Nemours & Company in 1925 as a fabric development specialist. The following year he established the first fabric development section in the rayon industry. He left the Du Pont Company in 1941 to join WPB.

Surviving are Mrs. Sommaripa and a son.

• ELECTED PRESIDENT, LOWELL TEXTILE INSTITUTE

Kenneth R. Fox, Assistant Professor of Textile Technology at the Massachusetts Institute of Technology in Cambridge, was elected President of the Lowell Textaile Institute on May 1st, by the unanimous choice of the Board of Trustees. He will succeed President Charles H. Eames who is to retire in June after holding the office for over forty years.

The new president is a graduate of the Lowell Textile Institute, receiving his Bachelor of Textile Engineering degree in 1938, and was graduated from the Massachusetts Institute of Technology in 1940, being awarded the degree of Master of Science in Textile Technology.

While at college, Professor Fox acquired wide experience; in 1933 and 1934 he was connected with the Newmarket Manufacturing Company, and in 1935 he was connected with the Horner Woolen Mills Company. He was manager of the Lowell Textile Associates, Inc., from 1937 to 1938. During the summer of 1939, he was a research assistant for the Textile Foundation work at M.I.T., and served in a similar capacity in the Textile Division of M.I.T. during 1940 and 1941. He then became an instructor at M.I.T., serving until 1943 when he was promoted to his present position. In addition to his academic interests, Professor Fox is vice-president of the Fabric Research Laboratories, Inc.

His honorary positions include: President of the Boston Microchemical Society, Fellow of the British Textile Institute, holder of the American Cotton Manufacturers' Association scholastic medal for 1938, Sigma Xi, and Tau Epsilon Sigma. He is a member of the American Association of Textile Chemists and Colorists, American Physical Society, The Textile Institute and the American Association of Textile Technologists.

● NEW LABORATORY CLINIC

As a new contribution to polymer chemistry, the Bureau of Highpolymer Research at the Polytechnic Institute of Brooklyn is offering its first laboratory clinic on "Weight and Shape of Polymer Molecules" for practicing chemists in a series of lecture and laboratory courses from 9:30 a.m. to 9:30 p.m. during the week of Monday, July 23 to Friday, July 27.

The clinic will be under the direction of Dr. Herman F. Mark, internationally noted authority on highpolymer chemistry, who is Professor of Organic Chemistry at the Polytechnic Institute and Director of the Highpolymer Research Bureau. Assisting members of Dr. Mark's scientific staff will be Dr. Turner Alfrey, Dr. William Badgley, Dr. Paul M. Doty, Dr. Kurt G. Stern, and Dr. Bruno Zimm, together with Sanford Davis, Irving Meyerson, and Seymour Singer.

This laboratory clinic is the first move to make the Polytechnic's research facilities for highpolymer chemistry, the most complete of their kind in the country, available to industrial chemists in a manner not possible in general graduate courses. Recently organized as a separate division, the new Highpolymer Research Bureau is said to be the first complete division for polymer chemistry in an educational institution in the United States.

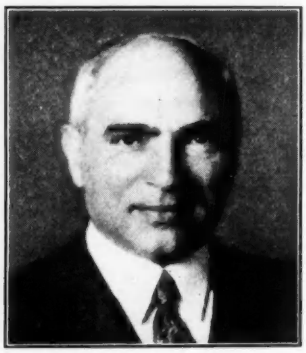
During the clinic it is planned to demonstrate in all details the various known physical and chemical techniques of polymer chemistry, including osmometry, viscometry, light scattering, ultracentrifuge, and diffusion and flow birefringence. There will be a thorough discussion of the proper preparation of samples, of the plotting and evaluating of data and of the interpretation of results.

● COMPLETES 30 COMBAT MISSIONS

First Lieutenant Richard E. Stafford, 22, of Middleboro, Mass., pilot of an Eighth Air Force B-17 Flying Fortress, has completed more than 30 combat bombing missions over enemy territory.

Lt. Stafford holds the Air Medal with five Oak Leaf Clusters for "meritorious achievement" on those missions, flown in the war's toughest air theatre. He is a member of the 388th Bomb. Group, a unit of the Third Air Division, the division cited by the President for its shuttle mission to Africa when Messerschmitt plants at Regensburg were bombed.

The Middleboro flyer is the son of Mrs. Mildred L. Stafford of RFD 1, Middleboro and his wife is Mrs. Eunice L. Stafford of Plymouth Street, North Middleboro. He was a textile chemist with the American Thread Company of Fall River before entering the AAF in November, 1942, and a member of the A.A.T.C.C.



Victor H. Berman

Victor H. Berman, President of the Onyx Oil & Chemical Company, Jersey City, N. J. has just been reappointed by Governor Walter E. Edge of New Jersey, as a member of the Interstate Park Commission, for a term of 5 years. This marks the third straight term Mr. Berman has served as a member of the commission for the State of New Jersey.

● BRAZILIAN COMMISSION SELECTS P.T.I.

The Brazilian Educational Commission, which is touring the United States studying methods of teaching in our scientific schools, selected the Philadelphia Textile Institute for inspection on education in textiles.

Their interest was particularly directed to the high standard of entrance requirements, including psychological and aptitude tests, the scope of instruction, and to the methods by which this textile college has been able to co-ordinate the teaching of theory and principles with practical instruction in the arts of textile manufacture.

The original arrangements for the visit were made by Theodore B. Hayward of Swift & Co., Secretary of The Philadelphia Textile Institute Foundation. The Commission also visited Franklin Museum and spent considerable time at the University of Pennsylvania, under the direction of Dr. John A. Goff, dean of its Towne Scientific School.

● 1945 FALL RAYON COLORS

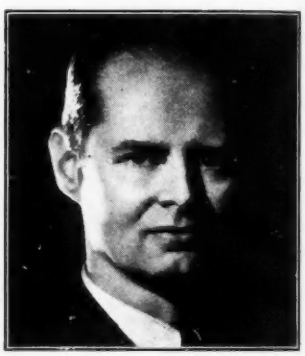
Chinese Dynasty Colors are highlighted in the advance 1945 Fall Rayon Collection, which The Textile Color Card Association has just issued to its members.

In addition to the above, the fall rayon collection comprises basic colors in twelve groups of light and medium tone-on-tones.

In full support of the Government's wartime conservation program, the Association, with the advice of its Dyestuff Advisory Committee, has selected the colors in the Rayon Collection not only for their style significance but in accordance with existing dyestuff regulations. All of these colors have also been chosen so that they are of a character that will offer a minimum of difficulty when they are reproduced on any fiber or mixtures of fibers, with considerations of limitations and restrictions of dyestuffs.

● CONSULTING CHEMIST

Dr. Johan Bjorksten, formerly Chemical Director of Quaker Chemical Products Corporation, has established an independent industrial research organization under the name of Bjorksten Laboratories, 185 North Wabash Avenue, Chicago 1, Ill.



Dr. Johan Bjorksten

Dr. Bjorksten received the M.S. degree in Chemistry, Physiology and Mathematics, at the University of Helsingfors, Finland in 1927. In 1928 he was a Guest Research Worker at the University of Stockholm, Sweden, with Dr. H. von Euler, the Nobel Prize Winner. He received the Ph.D. degree in Organic Chemistry in January, 1931, at the University of Helsingfors.

Dr. Bjorksten came to the U. S. in 1931 and spent the following year at the University of Minnesota with Dr. R. A. Gortner in post doctorate research on colloid chemistry.

● APPOINTED EXECUTIVE DIRECTOR

The appointment of Arthur Schroder as executive director of the American Institute of Chemists has been announced by Dr. Gustav Egloff, President of the Institute. Mr. Schroder will assume his new duties on May 1, having first been released from the Office of Alien Property Custodian, where he has been evaluating chemical patents seized from the Axis powers.

Mr. Schroder received his B.S. from the College of the City of New York, where he majored in chemistry and minored in engineering and mathematics. On gradu-

Arthur Schroder

ating he entered the employ of The Barrett Company and spent several years in research on the catalytic oxidation of benzol to maleic acid, naphthalene to phthalic anhydride and anthracene to anthraquinone.

Mr. Schroder has contributed numerous articles to the technical journals. He is a Fellow of the American Institute of Chemists, member of the American Chemical Society, the American Society for Testing Materials, the Electrochemical Society, the American Oil Chemists Society, and a trustee of the Chicago Chemists Club. He was Secretary of the Pittsburgh Section of the American Chemical Society for five terms, and for the past five years has been Managing Editor of The Chemical Bulletin, the official publication of the Chicago Section. He is also Vice-chairman, Director and Councilor of that section.

● ELECTED PRESIDENT

E. N. Brower, secretary-treasurer of the Rockfish Mills, Hope Mills, N. C., has been named president of the Carded Yarn Association by its excecutive committee, effective May 1. He will fill the unexpired term of Charles S. Northen, Jr., who resigned recently to accept a position with the Sloss-Sheffield Steel and Iron Company of Birmingham, Alabama.

● RETIRES FROM STEIN, HALL

Stein, Hall & Co., Inc., New York, has announced that John Goldstein, treasurer and a director, will retire from active business July 1st, after 37 years of association with the company.

Joining Stein-Hall as a shipping clerk in 1908, when the late Leo Stein and Frank G. Hall were partners in a small but fast expanding enterprise, Mr. Goldstein's advancement and the company's growth came together.

Mr. Goldstein will retire to his farm in Chalfont, Bucks County, Pa., and will be available to Stein, Hall in a consulting capacity.

● 50TH ANNIVERSARY

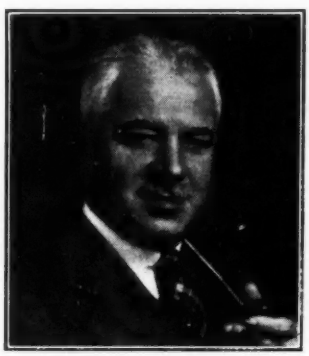
George Rahmann & Co., 31 Spruce St., New York, manufacturers of belting and leather products, held an informal dinner at the Hotel McAlpin on April 12th commemorating the fiftieth anniversary of the company in the machinery belting industry.

● ARMY-NAVY "E" AWARD

The United States Finishing Company announces that the Army-Navy "E" Production Award for High Achievement in War Production was presented to the men and women of the Sterling Branch, Sterling, Connecticut, Wednesday, April 11, 1945.

● ELECTED VICE-PRESIDENT

Dr. C. L. Mantell, technical director of United Merchants & Manufacturers Management Corporation, has been made Vice-President of United Merchants Laboratories, Inc., whose chemical and textile



C. L. Mantell

research laboratories, engineering department, and patent section serve the weaving, finishing, converting, merchandising, manufacturing, and foreign units of United Merchants & Manufacturers, Inc.

● DIRECTOR OF APPLIED RESEARCH

The Institute of Textile Technology in Charlottesville, Va., has appointed Dr. Willard H. Bennett of Columbus, Ohio director of applied research, effective January 20, 1945.

Dr. Bennett holds degrees from the Ohio State University (B.A., 1924), University of Wisconsin (M.S., 1926) and the University of Michigan (Ph.D., 1928).

He was a National Research Fellow in physics at California Institute of Technology from 1928 to 1930, then on the faculty of Ohio State University until 1938.

He gave up teaching to become director of research for the Electronic Research Corp. (1938-41) and has to his credit eighteen patents for his inventions. He is the author of nearly as many scientific papers in such periodicals as *Physical Review Journal of Applied Physics, Review of Scientific Instruments, Journal of Chemical Physics* and *Journal of the American Chemical Society*. He is co-author of a university textbook of physics for engineering students.

Willard H. Bennett

Dr. Bennett's industrial research was interrupted in September, 1941, when he was called to active duty and assigned to the Signal Corps with the rank of major.

He served first at Wright Field as section chief and project officer for the Aircraft Radio Laboratory, then as liaison officer at the Radiation Laboratory, Massachusetts Institute of Technology, before proceeding to the Southwest Pacific war theatre as a research and development officer for the Signal Corps.

At the Institute of Textile Technology Dr. Bennett is responsible for physical and mechanical research and its applications to textile manufacturing operations.

His long experience in research on electronics and electronic instruments, intensified during his three years of urgent military research, is regarded as an exceptional asset.

● RECEIVE HONORARY AWARDS

Two officials of E. I. du Pont de Nemours & Company of Wilmington, Del., received honorary awards at the seventy-fifth commencement of Syracuse University in Archbold Auditorium on April 30th.

An honorary doctor of laws degree was conferred on Howard J. White, assistant manager of the Du Pont Rayon Department. Ernest H. Hawkins, director of the Du Pont Purchasing Department, was awarded the Arents Medal "for excellence in commerce and industry." The awards were presented by Chancellor William P. Tolley.

● JOINS BUFFALO ELECTRO

Frank P. Greenspan, recently chemist with the Chemical Warfare Service, has joined the research staff of the Buffalo Electro-Chemical Co., Inc., Buffalo, N. Y. He holds an M.S. degree in Chemistry from the Polytechnic Institute of Brooklyn

and had previously been on the research staff of the Hart Products Corp., and chief chemist, Textile Laboratory, Lane Bryant, Inc.

● **ELECTED VICE PRESIDENT**

The Board of Directors of Monsanto Chemical Company have announced the election of Dr. Charles Allen Thomas, director of Monsanto's Central Research Laboratories at Dayton, Ohio, as a vice president of the company and at the same time announced that, effective September 1, 1945, he will become a member of the company's Executive Committee. Since 1942, Dr. Thomas has been a member of Monsanto's Board of Directors.

Dr. Thomas will move to St. Louis and assume his new duties as vice president immediately, being succeeded at Dayton as Central Research Director by Dr. Carroll A. Hochwalt, formerly associate director of the Central Research organization.

● **APPOINTED APEX AGENT**

Relative to the visit to the United States of Dr. Henry DeLaszlo, Managing Director of L. Light and Co. Ltd., Old Bowry Laboratories, Wraysbury, Bucks, England, manufacturers of fine chemicals, the Apex Chemical Co. Inc., of 225 W. 34th St., New York City, and Elizabeth, N. J., through its Operating Vice President, Stanford L. Hermann, is pleased to announce that effective August 1st, L. Light and Co. will act as agents in the United Kingdom for such Apex products as Lactic Acid, Thioglycollic Acid and their salts, as well as any other organic chemicals as may be required.

• CLASSIFIED ADVERTISEMENTS •

POSITION WANTED: Chemist-Executive age 40, with broad experience in research and manufacture of dyestuffs, seeks post-war connection with company planning new or more complete line of acetate colors. Write Box 679.

EXCELLENT OPPORTUNITY for technically trained graduate interested in textile research and development work. Responsible position with large, progressive New England textile manufacturer. Salary commensurate with ability and experience. Give all pertinent information and enclose recent photograph. Write Box 683.

WANTED: Young man for mill dyehouse laboratory, capable of testing dyestuffs, must be familiar with making formulas in laboratory for dyehouse production on cotton and rayon skeins and package. Box 684.

DYER WANTED: New England company seeking a man qualified by education and experience on synthetic fabrics, jig and box dyeing. Must be capable of taking full charge. Excellent post-war opportunity. Advise complete details on experience and starting salary. Replies will be treated with strictest confidence. Our own employees know of this ad. Box 685.

WANTED: COLORIST CHEMIST: Textile dyeing, screen printing, roller printing and finishing plant located Massachusetts wants a man qualified by education and experience to be Technical Director of operations. Should be working executive and practical plant man covering all phases of production. Advise complete personal history and salary requirements. Only an outstanding person of exceptional ability and record will be considered. Our employees know of this ad. Replies will be treated with strictest confidence. Box 686.

WANTED: Young textile chemist with few years experience in Southern Print Works to assist in development of resinous products for pigment printing and dyeing and later to act as technical representative for one of the larger chemical companies in this country. A good oppportunity for right man to progress quickly. Please furnish background, present draft status, availability and salary range expected. Box 687.

WANTED: Chemist to conduct research in resin emulsions and pigment resin emulsions for textiles. State experience, background, and desired salary. Box 689.

WANTED. Laboratory technicians for work in industrial research laboratory of Southern textile organization. In reply state age, experience, and approximate salary desired. Box 690.

WANTED: CHEMISTS: With textile and detergent experience. Immediate openings available with established chemical company. Permanent positions in sales service and research departments. Excellent salary and chance for advancement now and post-war. Give complete details. Box 691.

WANTED: Research Chemist, Assistant to Chief Research Chemist. Large textile manufacturing company in Newark, N. J., has opening for graduate chemist or chemical engineer. Good post-war opportunities. In reply give age, scholastic background, experience, draft status and salary expected. Box 692.

WANTED: Competent chemist, presently employed, who would enjoy research work in Florida on East Coast. Textile dyeing experience required. Reply stating past experience and present type of work. Box 693.

WANTED: Technically trained man, fully acquainted with the manufacture and use of softeners, sizes, finishes and surface active agents for the textiles and allied industries. Excellent opportunity for advancement. Applicants should state in detail qualifications and all previous employment, also salary desired. Box 694.

WANTED: Research chemists or Chemical Engineers. Large Textile manufacturer, vicinity of New York City. Organic and physical research. Position of permanent nature leading to group leadership in expanding research and control laboratories. If interested, send full details of education, experience, salary desired and personal data. Write Box 695.

NOTE

Essential employees need release statement. Employees who are to be hired for critical occupations need release statement and U. S. E. S. consent.